GENERAL DYNAMICS
Ordnance and Tactical Systems
Munition Services

September 7, 2012

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Richard Nussbaum P.E., R.G.,
Chief, Permits Section
MDNR Hazardous Waste Program
1730 E. Elm Street (lower level), P.O. Box 176
Jefferson City, MO 65102

Re: EBV Explosives Environmental Company
Class III Permit Modification
Permit No. MOD985798164

Dear Mr. Nussbaum:

EBV Explosives Environmental Company dba General Dynamics Ordnance and Tactical Systems Munitions Services (GD-OTS MS) received your comment letter dated June 14, 2012 on our Class 3 permit modification request for the upgrade of the Air Pollution Control Systems (APCS) at Building #3 Propellant Thermal Treatment Unit (PTTU).

GD-OTS MS is submitting the Human Health Risk Assessment Work Plan and Screening Level Ecological Risk Assessment Work Plan as prepared by O'Brien and Gere.

GD-OTS MS is responding to Comments #1 thru 3 of your letter.
#1 – Comments from TetraTech have been used in the development of the work plans;
#2 – Stack testing issues have been addressed in the development of the work plans;
#3 – EPA draft guidance has been used in the development of the work plans;

If you have any questions regarding this, please contact me at (610) 298-3085.

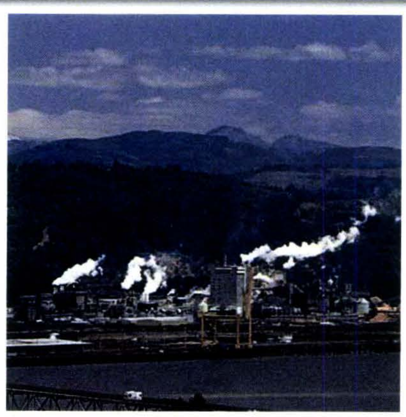
Very truly yours,

David R. Zoghby
Senior Director of Marketing
& Commercial Contracts

Attachments: HHRA Work Plan
SLERA Work Plan

cc. Tim O'Brien, MDNR HWP
Ken Herstowski, EPA Region 7

Human Health Risk Assessment Work Plan



General Dynamics Ordnance and Tactical Systems Munitions Services
Joplin, Missouri

September 6, 2012

O'BRIEN & GERE

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Human Health Risk Assessment Work Plan General Dynamics Ordnance and Tactical Systems Munitions Facility

Joplin, Missouri

Prepared for:

General Dynamics OTS Munitions Services
P.O. Box 1386
Joplin, Missouri 64802

WILLIAM A. SCHEW, VICE PRESIDENT
O'BRIEN & GERE ENGINEERS, INC.

O'BRIEN & GERE

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1. INTRODUCTION

The Missouri Department of Natural Resources (MDNR), has requested that General Dynamics-OTS Munition Services (GD-OTS MS) perform a human health risk assessment (HHRA) pursuant to the current Resource Conservation and Recovery Act (RCRA) Permit. This work plan is an update of the *Human Health Risk Assessment Work Plan* originally produced for the GD-OTS MS facility by ENSR/AECOM (2008) and incorporates the work plan review comments provided by Tetra Tech on behalf of the USEPA (Tetra Tech 2009; Appendix A).

This multipathway HHRA will evaluate the potential for health risk and hazard from air emissions associated with the operation of three buildings at the GD-OTS MS Facility in Carthage, Missouri. These building are: 1) Building 1 - MLRS/ ICM Disassembly building; 2) Building 3 - Propellant Thermal Treatment Process; and 3) Building 6 - Incineration Complex. Consistent with this request, GD-OTS MS has prepared this work plan for conducting a HHRA. The purpose of this work plan is to establish an approach for and describe the general methodology to be used in conducting an assessment of the potential health risk that could result from either direct or indirect exposure to emissions associated with Buildings 1, 3, and 6.

The HHRA will be conducted in general accordance with U.S. EPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (HHRAP; USEPA 2005a). The HHRA will consider multiple pathways of exposure. Examples of potential exposure pathways include inhalation of constituents emitted from Buildings 1, 3, and 6 (a direct exposure pathway) and incidental ingestion of trace constituents that may enter the food chain through deposition from the air to soil, plants or water bodies in the vicinity of the facility (potential indirect exposure pathways). Potential exposures and associated risks will be evaluated using the conservative assumptions recommended by USEPA in the HHRAP guidance.

In order to evaluate potential health risk, mathematical models will be used to calculate the anticipated atmospheric dispersion and deposition of emissions from Building 1, 3, and 6. The air dispersion and deposition modeling results will then be entered into the Lakes Environmental Software model IRAP-h View (Version 4.0), which will provide the basis for estimating exposure point concentrations in each environmental medium for each of the potential exposure pathway. The IRAP-h View model was developed with the intent that it could, in default mode, exactly follow the risk assessment methodology recommended in the latest USEPA guidance (USEPA 2005a).

The HHRAP (USEPA 2005a) suggests evaluation of three potential human exposure scenarios that may represent individuals or groups in the vicinity of the Site. The suggested scenarios include: a) residential; b) farming; and c) fishing. These suggested scenarios consider potential exposure of both adults and children through direct and indirect pathways associated with these scenarios. In addition to these three basic scenarios, USEPA Region 7 (USEPA 2006a) commissioned a Receptor Location Report that has identified an extensive set of site-specific receptors for evaluation in the HHRA. The Receptor Location Report is attached to this work plan as Appendix B, and it forms the basis for the assessment of human exposure in this work plan.

1.1 HHRA WORK PLAN ORGANIZATION

This HHRA work plan addresses each of the subject areas listed in U.S. EPA's HHRAP (USEPA 2005a). Section 2.0 characterizes the Site combustion sources and waste handling process and identifies chemicals that will be evaluated quantitatively in the HHRA, and the procedure for estimating chemical-specific emission rates. Section 3.0 presents the approach for dispersion and deposition modeling. Section 4.0 presents the exposure assessment methodology, which includes a brief discussion of the receptors (human population groups engaged in specific activities) in the Receptor Location Report (USEPA 2006a), exposure pathways, and exposure assumptions. Section 5.0 describes the Toxicity Assessment, which discusses the procedure for identifying dose-response values for the chemicals evaluated in the risk assessment. Section 6.0 discusses the human health risk characterization approach, including how uncertainties will be addressed and the target risk levels to which estimated cancer and noncancer risks will be compared. Section 7.0 presents all references.

2. CHARACTERIZING FACILITY EMISSIONS

The GD-OTS MS Joplin facility, constructed in 1994, treats reactive waste generated by the explosives manufacturing industry, users of explosive devices and materials, and government agencies. The facility is located in rural Jasper County, Missouri, on County Road 180 about 3 kilometers (km) north of U.S. Interstate 44 (Figures 1 and 2) and is part of the Tri-State Mining District that was an active zinc-lead mining area until 1957.

The EPA Facility ID #, Mailing Address, and Primary Contact are presented below.

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Facility ID#: MOD 985 798 164

2.1 BASIC FACILITY INFORMATION

The GD-OTS MS Facility consists of numerous operating buildings and areas, and storage magazines, located within a 55-acre site. The discussion in this section is limited to the buildings that contain thermal treatment units (Buildings 1, 3, and 6; Figure 3). Refer to Appendix C for a description of all Site buildings.

2.1.1 Building No. 1 MLRS/ICM Disassembly Building

The MLRS/ICM Disassembly Building consists of two separate area, a non-RCRA regulated disassembly area, and a RCRA Subpart X thermal treatment area. In the non-RCRA area, military munitions are downloaded in safety cells and the submunitions disassembled using unattended, automated equipment to remove and disassemble the submunitions. Disassembled submunitions are subsequently thermally treated in the RCRA Subpart X area of the building.

The RCRA Subpart X thermal treatment area consists of four Contained Thermal Treatment Chambers (CTTC) where the explosives in the submunitions are ignited by natural gas fired torches and allowed to burn in the chambers. There also are four electrically-heated Static Kilns (SK) in which the fuzes from the submunitions are thermally treated. Emissions from the thermal treatment of the explosives in the submunitions and fuzes are controlled by Air Pollution Control Systems (APCS) servicing the thermal treatment processes.

The body of the submunition contains 17% (30 grams) of explosive material and no RCRA regulated chemicals. The submunition body is placed in a fixture on a conveyor that runs through a CTTC. The explosive material in the body is ignited by a natural gas fired torch and allowed to burn. All of the explosive material in each body is consumed in about 1 minute. Clean scrap metal is collected in the residuals area of this process. The chambers are held at a negative pressure by an induced draft fan on the APCS through which the emissions are pulled for cleaning. The CTTC APCS consists of a Primary Cartridge Filter, and a H13 HEPA Filter to remove the very small amount of particulates that are generated by the burning explosives, and an Induced Draft Fan to pull all emission from the chambers thru the APCS to the Stack.

The second part of the submunition is the fuze that contains <1% (88 milligrams) explosive material with less than 0.38% lead. This fuze is conveyed into a separate chamber where it is dropped into an electrically heated SK. The heat from the electric heater on the outside of the SK causes the explosive materials to ignite. The emissions from the burning of the explosive material may include a minute amount of lead, which is pulled into the SK APCS for cleaning. Since the SK is a batch type unit, GD-OTS MS has four SKs with the emission going to the APCS referenced above. Only one SK is operated at a time. While the one kiln is in operation and reaching filling capacity, a second SK is heated in preparation for receiving the fuzes for thermal treatment. A third SK would be in the process of cooling down from completion of a batch treatment prior to opening the SK and removing the metal residue. A fourth SK is used as backup during routine maintenance of the SKs. The APCS for the SKs is a Primary Cartridge Filter and H13 HEPA Filter, with an induced draft fan to pull all emissions from the SKs through the APCS to the Stack.

2.1.2 Building No. 3 Propellant Thermal Treatment Process

The Propellant Thermal Treatment Process is a RCRA Subpart X regulated process for disposal of the MLRS rocket motors. It consists of a Preparation Bay, two Saw Bays, a Transfer Room, two Propellant Thermal Treatment Chambers (PTTC), and an APCS. The Rocket Motor contains 216.5 pounds of a case bonded Ammonium Perchlorate based propellant. In this process, the MLRS rocket motors are cut into segments using underwater saws. The cut segments are transferred from the saw bays into a Transfer Room, then into one of the two PTTCs where they are ignited using a natural gas fired torch. The torch ignites the propellant which is allowed to burn in the rotary conveyor inside of the PTTC. Clean scrap metal is collected in containers. The chamber is held at a negative pressure by an induced draft fan on the APCS through which the emissions are pulled.

The APCS consists of a Quench Chamber to cool the gases and to inject the sodium bicarbonate to neutralize the chlorine and acid gases, a Reaction Chamber (former Spray Dryer) to increase the neutralization and where activated carbon is injected for organics removal, a Baghouse to filter the particulates and a Wet Scrubber to complete the neutralization and particulate filtration of the exhaust gases. An Induced Draft Fan pulls all emission from the chambers thru the APCS to the Stack.

2.1.3 Building No. 6 Incineration Complex

The Incineration Complex consists of two incinerators. The hazardous waste handling operations are performed in accordance with RCRA regulations. The Incineration Complex consists of a Control Room, Feed Room, Kiln Containment Room, Residuals Handling Room, 90-Day Storage Area, Air Pollution Control System Area, Induced Draft Fan Area, Controlled Emissions Monitoring Building, Utilities Building, and Car Bottom Furnace.

The Control Room is where the incineration process and feeding operations are controlled for the Rotary Kiln Incinerator (RKI) and Car Bottom Furnace (CBF). This room is adjacent to the Feed Room and the Kiln Containment Room, separated by concrete blast walls. All operational controls for the incineration plant, consisting of a redundant Distributed Control Systems (DCS), are located in the Control Room. Plant operators observe the kiln feeding operation via closed-circuit television (CCTV) monitors. In addition, the Control Room monitors all other operations in the Plant Operations Area using CCTV monitors, including operations at the Magazines. There are numerous CCTV Cameras located throughout all of the plant operations. Multiple monitors are located in the Control Room by which plant operations are monitored.

Waste from magazines or from the Storage/Feed Handling Building is loaded onto a transport vehicle for carrying the waste to the Feed Room. A maximum volume of waste sufficient for up to four hours of incineration operation is moved at one time. The unloading area is covered by a metal roof. The unloading pad is concrete with berms to contain all spills. Wastes are introduced into the RKI from the Feed Room.

The Kiln Containment Room houses the charge conveyor, the RKI, and portions of the feed conveyor and the discharge skip hoist.

The Residuals Handling Room contains a vibrating conveyor for separating the ash and metals discharged from the RKI. Metals are recovered for recycling and ash is collected for disposal as hazardous waste in a permitted HW landfill.

The 90-Day Storage Area is a curbed concrete pad within a three-sided metal building. A drain from the concrete pad is connected to the APCS area collection sump to control spills and precipitation. Ash residuals for disposal are dumped into ash roll-off containers for transport to an off-site, permitted, hazardous waste landfill for disposal. A residuals sampling program is utilized to ensure proper disposal of all residuals. Residual metals are inspected in this area to ensure they have been inerted by the incineration process. Residual metals are dumped in roll-off bins for removal from the site and transport to commercial recycling facilities.

Building 6 - Air Pollution Control System Area

The APCS area includes the Secondary Combustor, Spray Dryer, Baghouses and support equipment. After exiting the RKI or the CBF, the exhaust gas enters the Secondary Combustor, where the gas is heated to 1800 - 2200°F by burning natural gas auxiliary fuel. This elevated temperature, in conjunction with the gas residence time of greater than four seconds, ensures the complete destruction of organic materials. After exiting the Secondary Combustor, the exhaust gas then enters the Spray Dryer into which soda ash slurry is sprayed to remove acid gases as well as to cool the exhaust to the operating temperature range of the Baghouse. The exhaust gases leaving the Spray Dryer are then sent to the Baghouses. The dust collected on the bags is removed by reverse pulses of compressed air being applied to the inside of the bags. The dust falls to the bottom of the Baghouse where it is removed through a rotary valve. The dust is placed in the ash roll-off and sent to a RCRA-approved hazardous waste landfill.

All of the APCS equipment is located on a curbed concrete pad which is sealed with an epoxy coating to prevent leakage of water from the pad. Rain water and any other water that falls on the APCS pad flows into the Sump where it is pumped into Tank TK-103 from which it is pumped for use in the spray dryer as quench water. In this manner, no liquid effluent from the APCS leaves the plant.

Two parallel induced draft fans are provided to move the exhaust gas to the stack. Each fan is designed to handle 100 percent of the total gas flow. Both fans are generally operated at the same time, unless it is necessary to shut down one of the fans for maintenance. The stack is 65 meters in height.

The Continuous Emissions Monitoring Building is located at the base of the stack. Located in the building is the sampling equipment that continuously monitors the stack gases for carbon monoxide, hydrocarbons, oxygen, opacity, and stack flow rate/temperature.

The Utilities Building houses the Soda Ash Tanks where soda ash is mixed and metered to the spray dryer in the APCS for acid gas control. It also houses the air compressors that provide compressed air supply for operating the plant, an emergency backup generator for supplying electricity to allow an ordered shutdown of the plant in the event of an electrical power failure, and the electrical motor control center.

Building 6 - Car Bottom Furnace

The CBF is a natural gas fired incinerator designed to decontaminate large, unusual or irregular shaped metal pieces and incinerate contaminated combustible materials such as rags, coveralls, and packaging materials. The furnace system consists of a CBF, Overhead Hoist, Car Bottom Furnace Track Scale and a Car Bottom Furnace Baskets.

2.2 IDENTIFYING EMISSION SOURCES AND ESTIMATING EMISSION RATES

The emission sources at the GD-OTS MS Carthage facility have been well characterized and consist of the operation of three processing buildings with thermal treatment units: 1) Building 1 (one SKS, four identical CTTCs); 2) Building 3 (PTTC); and 3) Building 6 (RKI and CBF). The following sections describe the stack emissions, potential upset emissions, and RCRA fugitive emissions from these units.

Prior to discussing these factors, GD-OTS MS wishes to highlight two constituents that have not been evaluated in any Comprehensive Performance Tests (CPT) to date: aluminum and hexavalent chromium.

Aluminum: Prior to the conduct of the air dispersion modeling and the risk assessments, the emissions from Building 3 will be tested for Aluminum. The emissions from Buildings 1 and 6 will not undergo testing for this constituent. This decision is based on the fact that the waste processed in Building 3 typically contains aluminum while the waste processed in Building 1 does not. As only a small fraction of the feed stock for Building 6 contains aluminum, the emissions from this facility will not be tested for this constituent.

Chromium: To date, chromium emissions from all three subject buildings have not been speciated (i.e., hexavalent chromium emissions are unknown). With respect to human health, hexavalent chromium is the most toxic form of chromium. In addition, hexavalent chromium is a known human carcinogen by inhalation. Therefore, as a conservative measure, all chromium emitted from these buildings will be assumed to be in the hexavalent form in the HHRA. If the risk and hazard estimates that result from this conservative assumption exceed acceptable thresholds then additional information (e.g., results of facility ash analyses and existing literature) will be used in the uncertainty section of the HHRA to discuss the most likely speciation of this element and how this speciation would impact risk/hazard estimates.

2.2.1 Estimating Stack Emissions for Existing Facilities

The information in the following sections provides a short summary of the Comprehensive Performance Tests (CPT) for the emission units associated with the subject buildings. The results of the CPTs will be used to develop the Constituent of Potential Concern (COPC)-specific emission rates that will serve as an input into the IRAP-h View. These COPC-specific emission rates have not been developed as of the writing of this HHRA Work Plan. General Dynamics proposes to develop these emission rates in accordance with the HHRAP guidance (USEPA 2005a) and submit the proposed factors to the USEPA and the MDNR as an interim deliverable prior to running the IRAP-h View model.

Building 1

The emission units housed in Building 1 include one SK System and four identical CTTUs. The CPT for the SK and CTTCs was conducted during the week of June 25-29, 2012 in accordance with an approved CPT Plan and under full oversight of USEPA Region 7 and the MDNR. This CPT was designed to address the permit requirements for these emission units and included feeding the maximum quantities of the specified waste into each thermal treatment system, characterization of these feedstreams, monitoring of certain process parameters and conducting emissions testing. The following COPCs were evaluated during this CPT: dioxins and furans, semi-volatile metals (arsenic, chromium and beryllium), low volatile metals (lead and cadmium), particulate matter, mercury, hydrogen chloride, and chlorine gas.

Building 3

The emission units housed in Building 3 include the PTTU. The CPTs for the PTTU were conducted in accordance with an approved CPT Plan and under full oversight of USEPA Region 7 and the MDNR. The CPT was also conducted at a single set of operating conditions that included feeding the maximum quantities of the specified waste into the thermal treatment system while operating the APCS at worst case conditions.

The initial CPT for the PTTU was conducted during the week of April 23-27, 2012 for dioxins and furans, semi-volatile metals (arsenic, chromium and beryllium), low volatile metals (lead and cadmium), particulate matter, hydrogen chloride, and chlorine gas. Results from the initial CPT showed that all emission standards were met with the exception of dioxin and furan emissions which exceeded the RCRA Permit emission limit. Accordingly, a retest was performed during the week of May 28–June 1, 2012 and again test results were above the RCRA Permit limit. A third dioxin and furan test program was conducted during the week of June 18-22, 2012. Triplicate test runs were conducted at two conditions that involved operating the newly installed activated carbon system at two different injection rates. Dioxin and furan emissions at both test conditions were within the RCRA Permit limits.

Building 6

The emission units housed in Building 6 include the RKI and CBF. The CPT for these units was conducted during the week of June 13, 2011 in accordance with an approved CPT Plan and under full oversight of the MDNR. The CPT was conducted at a single set of operating conditions that included feeding the maximum quantities of the specified waste into the thermal treatment system while operating the APCS at worst case conditions. The following COPCs will be evaluated during this CPT: dioxins and furans, semi-volatile metals (arsenic, chromium and beryllium), low volatile metals (lead and cadmium), particulate matter, hexachloroethane, naphthalene, total hydrocarbons, hydrogen chloride, and chlorine gas.

2.2.2 Emissions from Process Upsets

USEPA guidance suggests that upset emissions may result from upsets in the hazardous waste combustion process. Upset emissions are generally expected to be greater than stack emissions because the process upset results in incomplete destruction of the wastes or other physical or chemical conditions within the combustion system that promote the formation and/or release of hazardous compounds from combustion stacks. Upset emissions usually occur during events and times when the hazardous waste combustion unit is not operating within the limits specified in a permit or regulation.

The HHRAP indicates that, if available, information on the frequency, duration and causes of automatic waste feed cutoffs (AWFCOs) can be utilized to derive site-specific upset emission factors. Since the emission units and APCSs associated with Buildings 1, 3, and 6 have been in operation for a significant period of time, records of process upsets and continuous monitoring of stack gas parameters such as carbon monoxide will be used to establish upset factors that are representative of each building. These building-specific upset factors have not been developed as of the writing of this HHRA Work Plan. General Dynamic proposes to develop these upset factors in accordance with the various guidance documents listed in Section 2.2.5 of the HHRAP (USEPA 2005a) and submit these upset factors (and the rationale for their development) to the USEPA and MDNR as an interim deliverable prior to running the IRAP-h View model.

2.2.3 RCRA Fugitive Emissions

Fugitive emissions are typically associated with the release of compounds or pollutants from leaks in combustion chambers (e.g., "puffs"); tanks, valves, flanges, and other material handling equipment used in the storage and handling of RCRA hazardous wastes as part of the combustion process. However, Buildings 1, 3, and 6 are unique because the combustion units are located in enclosed rooms where the air is exhausted through a bank of filters specifically designed to control fugitive emissions.

Off-design fugitive emissions are not expected to escape from Buildings 1, 3, and 6 for the following reasons:

- The waste that is thermally treated in these building is a solid material consisting of cluster munitions, grenades, fuses, rocket motors, etc.;
- The volatility of these munitions and munitions components is so low that no special PPE is required for operators handling the devices;
- The treatment chambers, ductwork, and primary filters are all maintained under negative pressure by the induced draft fan (the only part of the APCS that is not under negative pressure is the HEPA filter and activated carbon filter).

Although it is not possible to completely eliminate all transient pressure spikes in the thermal treatment chambers, the engineering features of the thermal treatment systems and their associated APCSs virtually eliminate the potential for fugitive emissions. The potential for fugitive emissions from these facilities is limited to those that could potentially escape during unintended periods of poor operating conditions resulting from malfunction, error, power failure or other unpredictable events. However, such occurrences will be treated as true "upsets" and dealt with by the application of an upset factor (see Section 2.2.2 above) if necessary. Therefore, fugitive emissions from Buildings 1, 3, and 6 will not be addressed in this HHRA.

2.3 IDENTIFYING COMPOUNDS OF POTENTIAL CONCERN

The primary source of emissions data used to select COPCs will be measurement results obtained from the CPTs for Buildings 1, 3, and 6. The CPTs for the subject buildings were conducted in accordance with approved CPT Work Plans and under full oversight of USEPA Region 7 and the MDNR.

The CPTs sampled the gases discharged from the exhaust stacks for the following parameters:

Building 1: dioxins and furans, SVOC emissions, total hydrocarbons, semi-volatile metals (arsenic, chromium and beryllium), low volatile metals (lead and cadmium), particulate matter, mercury, hydrogen chloride, and chlorine gas

Building 3: dioxins and furans, semi-volatile metals (arsenic, chromium and beryllium), low volatile metals (lead and cadmium), particulate matter, hydrogen chloride, and chlorine gas

Building 6: dioxins and furans, semi-volatile metals (arsenic, chromium and beryllium), low volatile metals (lead and cadmium), particulate matter, hexachloroethane, naphthalene, total hydrocarbons, hydrogen chloride, and chlorine gas

At a minimum, these will be the targeted stack gas COPCs evaluated in the HHRA.

As with all combustion sources, there are a large number of compounds that could potentially be evaluated in the risk assessment. In addition to the compounds that are fed to the industrial furnaces for destruction, products of incomplete combustion (PICs) must be considered. The HHRAP (USEPA, 2005a) has developed a six-step approach for evaluating potential facility emissions to ensure that all reasonable possibilities are considered in the identification of potential COPCs.

As recommended by the HHRAP (USEPA 2005a), the method for identifying COPCs for inclusion in the HHRA will consider the following six steps:

1) Evaluate analytical data from the CPT to determine which compounds are detected in the stack emissions.
2) Evaluate all wastes that the unit will be permitted to burn. Retain for evaluation any non-detect compound present in the waste.
3) Retain for evaluation any non-detect with a high potential to be emitted as a PICs.
4) Retain for evaluation those compounds that (1) are a concern due to site-specific factors, and (2) may be emitted by the combustor.
5) Research the recommended hierarchy of human health toxicity data (see Section 5.1) for available compound-specific health benchmarks. Add compounds with available toxicity data to the COPC list for ***quantitative*** assessment. Retain compounds that have no toxicity data on the COPC list for ***qualitative*** assessment, or use surrogate toxicity data from a toxicologically similar compound.
6) Evaluate the tentatively identified compound (TIC) peaks obtained during gas chromatography (GC) analysis, to determine whether any of the TICs have toxicities similar to the detected compounds. If they do, qualitatively assess using surrogate toxicity data as recommended for identified compounds in Step 5.

Throughout the COPC selection process, compounds with recognized toxicity criteria (i.e., from the USEPA recommended hierarchy of databases) are given precedence. As outlined in the HHRAP (USEPA, 2005a), when a compound has no such data available, a reasonable attempt will made to determine whether there are appropriate surrogate compounds that could represent compounds that do not have recognized toxicity data.

General Dynamics proposes to identify a list of COPCs emitted from Buildings 1, 3, and 6 in accordance with the HHRAP guidance (USEPA 2005a) and submit the proposed list to the USEPA and the MDNR as an interim deliverable prior to running the IRAP-h View model.

2.4 ESTIMATING COPC CONCENTRATIONS FOR NON-DETECTS

Section 2.3 (above) outlines a protocol for developing a list of COPCs for the emission associated with Buildings 1, 3, and 6. Steps two and three of the six-step USEPA protocol recommend the retention of non-detected compounds that are expected due to the composition of the waste stream or compounds that have a high potential to be emitted as a PIC. The HHRAP guidance (USEAP 2005a) recommends the following protocols for managing non-detects for constituents that might be COPCs:

1) Use the Method Detection Limit (MDL)-derived reliable Detection Limit (RDL) to quantify non-detects for COPCs analyzed with non-isotope dilution methods; and
2) Use the method-defined Estimated Detection Limit (EDL) to quantify non-detects for COPCs analyzed with isotope dilution methods.

The interim deliverable described throughout this section will also include a discussion of the methodology used to manage non-detects associated with the CPT for Buildings 1, 3, and 6.

3. AIR DISPERSION AND DEPOSITION MODELING

Air dispersion and deposition modeling will be conducted to estimate unitized air impacts and deposition rates for the emissions from Buildings 1, 3 and 6 to support the human health and ecological risk assessments. The modeling will be conducted with USEPA's current guideline model, AERMOD Version 12060 (USEPA Guideline on Air Quality Models as incorporated in Appendix W of 40 CFR Part 51).

The AERMOD modeling analysis will be conducted in accordance with USEPA recommendations for conducting modeling in support of the risk assessments as outlined in the HHRAP guidance (USEPA, 2005a). The modeling procedures and input requirements are discussed in this section.

3.1 SOURCE DATA

In addition to the emissions data (discussed in Section 2.0), stack parameters for Buildings 1, 3 and 6 will be required for the modeling. The following stack data will be compiled and summarized in the risk assessments:

- Stack height;
- Stack diameter;
- Exhaust velocity; and
- Exhaust temperature

The modeling will be performed with a unit (1 gram/second; g/sec) emission rate. Pollutant-specific air concentrations and deposition rates will be determined within IRAP-h View by multiplying the normalized impacts by the emissions in g/sec.

In addition to the physical stack parameters and exhaust stack parameters, particle size distribution data on stack emission are required to perform deposition modeling. If unit-specific particle size distribution data are not available, the aerodynamic size distribution of emitted particulate will be based on published data for units that are expected to have similar particle size distribution to the sources in this analysis. If the available data is not representative of the emissions expected from Buildings 1, 3, and 6, the AERMOD "Method 2" may be utilized in the model in lieu of "Method 1". Method 2 does not require a detailed particle size distribution, but rather, relies on the assumption that a small fraction (less than 10 % of the mass) is particles with a diameter of 10 micrometers or larger.

In accordance with the HHRAP, two different particle size distributions will be modeled. The distribution of particle mass will be used to represent all metals except arsenic, lead, and mercury when present. Semi-volatile organic species and low boiling point metals (such as arsenic and lead) that tend to vaporize during combustion and condense on the surface of emitted fly-ash are represented by a surface area-weighted size distribution ("particle-bound"). This approach tends to produce more realistic (and often lower) deposition rates of these materials in the immediate vicinity of the source. The proposed particle distributions and accompanying discussion of their development will be included in the risk assessment reports.

In addition to the source data described above, building data are also required for stacks potentially subject to aerodynamic building downwash. The Receptor Location Report (USEPA 2006a) states that "Evaluation of the air modeling output indicates that building downwash is not significant." However, the statement is based on the air dispersion modeling conducted for the 1995 HHRA. Therefore, the potential for downwash will be reevaluated.

The analysis used to evaluate the potential for building downwash is referred to as a "Good Engineering Practice" (GEP) stack height analysis. The GEP stack height analysis is conducted using the USEPA's Building Profile Input Processor (BPIP) program. Building dimensions required for input to AERMOD are developed by BPIP for stacks less than the GEP height. To conduct the GEP analysis, a facility plot plan showing the locations of Buildings 1, 3 and 6 relative to existing and/or proposed buildings and structures at the facility is required. The building and structural elevations will also be compiled and documented.

3.2 METEOROLOGICAL DATA

Five years of meteorological data from the nearest representative National Weather Service station are required to conduct the dispersion and deposition modeling. Five years of surface meteorological and precipitation data from Springfield, Missouri and five years of concurrent upper air data from Monet, Missouri will be compiled and processed for input to AERMOD.

AERMET, USEPA's meteorological pre-processor for AERMOD, will be used to consolidate the hourly surface and precipitation data and upper air data. The five years of processed meteorological data will be combined into a single meteorological data file for input to AERMOD to compute five-year averages of air concentrations and deposition rates as recommended by the HHRAP. In addition to the raw meteorological data, site characteristics including surface roughness, albedo and Bowen ratio will be identified using USEPA's AERSURFACE program. AERSURFACE incorporates the current USEPA guidance for calculating surface roughness; albedo and Bowen ratio as contained in the USEPA AERMOD Implementation Guide (USEPA 2009). Surface roughness will be calculated based on land use 1-km upwind from the meteorological tower.

3.3 APPLICATION OF AERMOD

AERMOD will be applied to determine maximum short-term air concentrations and long-term averages (based on five years modeled) of air concentrations as well as wet, dry, and total deposition for vapors, particles, and particle-bound chemicals. As such the following iterations will be conducted with AERMOD to obtain the modeled air concentrations and deposition rates required for input into IRAP-h View:

1) Wet and dry deposition of particles, based on mass-weighted particle distribution including plume depletion;

2) Wet and dry deposition of particles, based on area-weighted particle size distribution including plume depletion; and

3) Wet and dry deposition of vaporous gases with plume depletion.

The risk assessment study areas and modeling domain will include an area within 10-km of the facility. This domain will be sufficient to resolve the maximum modeled impacts from Buildings 1, 3 and 6 and will cover the local sections of nearby water bodies and watersheds.

Land use within 3-km of the facility will be classified in accordance with the USEPA recommended method based on information contained on U.S. Geological Survey (USGS) maps and satellite photography. This classification is used to determine whether AERMOD will be run in a rural or urban mode.

A comprehensive Cartesian receptor grid will be developed for the dispersion and deposition modeling per the HHRAP guidance. Specifically, the Cartesian receptor grid will consist of 100 meter (m) spaced receptors from the fence-line out to 3-km and 500-m spaced receptors beyond 3 km out to 10 km. In addition, the facility fenceline will be delineated by discrete receptors placed at 50 m intervals along the property boundary line. Alternatively, pending USEPA's approval, the QD (Quantity Distance) Safety Arcs will be used instead of the facility fenceline (see Section 4.1.2 of this work plan for a discussion of this issue). Ultimately, the receptor spacing will be adequate to resolve maximum impact areas and impacts at key/sensitive receptor locations recommended for evaluation in the Receptor Location Report (USEPA 2006a).

Receptor terrain elevations and receptor information required by AERMOD will be developed though application of the receptor/terrain processor AERMAP. AERMAP will utilize terrain elevations obtained from Digital Elevation Model (DEM) data (30-m resolution) acquired from USGS.

Modeling results will be presented in the final risk assessment reports as isopleths of unitized concentrations and deposition rates with coordinated tables showing the relative exposure impacts of Buildings 1, 3 and 6 at selected locations of importance for the risk assessments.

All model input and output files will be provided to the MDNR and USEPA Region-7 on CDROM, including model output in a format ready for input into the IRAP-h View risk modeling program.

4. EXPOSURE ASSESSMENT

In this step of the risk assessment process, hypothetical human receptors and potential exposure pathways through which such receptors may be exposed to facility-related COPCs are identified. This exposure assessment is based on the characteristics of the facility and surrounding area, and activities that could take place in the vicinity of the facility. Dispersion of COPCs into the ambient air allows direct human exposure to COPCs through inhalation. Due to deposition onto soil, water or plants (such as vegetables), the COPCs are also available for indirect exposure through ingestion of soil, water, or plant material. Additionally, the COPCs are potentially available to other secondary indirect pathways of exposure, including ingestion of locally raised agricultural products (beef, dairy, pork, and poultry products), or consumption of locally caught fish. The goal of the exposure assessment is to predict the magnitude of possible human exposure to COPCs in emissions from the facility through potential exposure pathways.

In the combustion risk assessment process, the air dispersion and deposition modeling, discussed in Section 3.0, provides the foundation for all other environmental concentration modeling efforts. The final air dispersion and deposition modeling results will be entered into the Lakes Environmental Software model IRAP-h View (Version 4.0), which will provide the basis for estimating exposure point concentrations in each environmental medium for each of the potential exposure pathways discussed below.

4.1 SURROUNDING LAND USE AND SURFACE WATER

The property directly surrounding and within at least 1000 feet of the GD-OTS MS Facility, in all directions, is owned by Expert Management, Inc. (EMI). Much of this property was originally used for the manufacturing of commercial explosives. However, all operations on EMI property have been discontinued, all facilities have been demolished, and the majority of the land returned to its natural state. The EMI property is currently undergoing environmental remediation or awaiting approval of remediation plans. Surrounding the EMI property, the land can be characterized as agricultural crop land and pasture, light industrial, mixed rangeland and mixed forest land. There are some small residential areas; however, the majority of the surrounding properties are small to mid-sized farms.

Water courses nearest the GD-OTS MS facility include Center Creek, Grove Creek, and some minor unnamed tributaries to these creeks. In addition, there are some small unnamed ponds located more than 1,000 feet from the GD-OTS MS Facility. Grove Creek flows through the EMI property, and is less than one-half mile from the GD-OTS MS Facility. There are no injection wells on the GD-OTS MS Facility, or within 1,000 feet of the GD-OTS MS Facility. No fluids from the GD-OTS MS Facility are injected into underground wells. There is one withdrawal well for providing the plant water supply located on the GD-OTS MS Facility.

4.2 IDENTIFICATION OF POTENTIAL RECEPTORS AND EXPOSURE SCENARIOS

The HHRAP (USEPA 2005a) suggests the evaluation of three pairs of potential receptors: a non-farming, resident (child and adult); a subsistence farmer (child and adult); and a subsistence fisher (child and adult). However, the exact receptors to be evaluated should be based on site-specific land use and human activity patterns.

The potential receptors and exposure scenarios to be evaluated in the HHRA were identified in the Receptor Location Report developed for USEPA Region 7 by Tetra Tech (USEPA 2006a, attached to this work plan as Appendix B). The receptors selected in the Tetra Tech report reflect site-specific land use and activity patterns. While the site reconnaissance conducted for this report evaluated land uses within a 10-km radius of the facility, the characterization of the exposure settings focused on a 3-km radius from the facility because the highest concentrations COPCs will be deposited in this area.

As this Receptor Location Report is six years old, O'Brien & Gere compared the aerial photography from 2006 to that of 2012 and found that, while there have been several buildings added to the GD-OTS MS facility, there are few other discernible differences in land use in the area around the facility. This is particularly true of the area within a 3-km radius of the facility. The 2011 Joplin Tornado did pass within 5-km to the southwest of the GD-OTS MS facility but the path of the tornado area is outside of the 3-km facility radius and well beyond the locations of the selected receptors.

Based on the Receptor Location Report (USEPA 2006a), there are numerous small farms, a few small residential areas, isolated residences, and two creeks within 3 km of the facility. A drinking water intake is located about 15 km southwest of the facility on Shoal Creek (Figure 1 in Appendix B). The Receptor Location Report states that the Missouri American Water Company supplies drinking water to GD-OTS MS facility and the Cities of Duenweg and Joplin (USEPA 2006a). While the Missouri Water Company does supply the Cities of Duenweg and Joplin, a recent communication with the point of contact for the GD-OTS MS facility indicates that the facility provides bottled water for their employees (Mr. Dave Zoghby, personal communication, August 16, 2012). The on-site water system originates from a groundwater well and is used only for process water, fire water, and water for bathrooms, but not for drinking. The only areas of standing water observed within 3 km of the facility were tailings ponds. The chronic and acute exposure scenarios identified in the Receptor Location Report are discussed briefly below and detailed in Appendix B (Receptor Location Report; USEPA 2006a).

4.2.1 Chronic Exposure Scenarios

Based on information contained in the Receptor Location Report (USEPA 2006a; Appendix B), the following chronic exposure scenarios will be evaluated in HHRA:

- Current and reasonable potential future residential scenarios – adult and child
- Current and reasonable potential future farmer scenarios – adult and child
- Current and reasonable potential future fisher scenario (the Grove Creek reach behind the facility and Center Creek) – adult and child
- Deer hunting scenario – adult
- Turkey hunting scenario – adult and child

Each of the exposure scenarios recommended in the Receptor Location Report, with the exception of the hunter scenarios (deer and turkey), is a standard scenario recommended in the HHRAP guidance and can be found in the IRAP-h View software. To accommodate the evaluation of the deer and turkey hunting exposure scenarios within the IRAP-h View software, the livestock exposure pathways recommended as part of the farmer scenario will be manipulated to evaluate the hunter scenario. Some of the information necessary for evaluating these non-standard pathways is provided in the Receptor Location Report. Additional information necessary for estimating uptake into deer and turkey will be obtained via a search of the published literature. If information specific to deer and turkey cannot be located, the HHRA for these receptors will be conducted using default values derived for beef and chicken, which are available in the HHRAP.

Seven locations at which residents live have been identified in the Receptor Location Report for evaluation (USEPA 2006a; Appendix B). A reasonable potential future resident scenario will also be evaluated at the off-site location with the highest modeled soil concentration to ensure that potential exposures for a future resident are not underestimated.

Four farming locations have been identified for evaluation in the HHRA (USEPA 2006a: Appendix B). A reasonable potential future farmer scenario will also be evaluated at the off-site location with the highest modeled soil concentration to ensure that potential exposures for a future farmer are not underestimated.

The fish ingestion pathway will be evaluated separately for Grove Creek and Center Creek based on maximum COPC deposition rates corresponding to these water bodies and their watersheds. The locations where the recreational deer hunting exposure scenario will be evaluated include wooded habitat north and east of the facility. Location D2 (north of the facility) is close to the facility boundary/ QD Safety Arcs. This location will be moved to the north until it is outside of the GD/EMI property as hunting is prohibited on these properties and ATF/DoD regulations related to explosive magazines and safe havens prohibit hunters from entering the QD Safety Arcs. The pasture habitat on the west side of CR 180 and natural land near the confluence of Grove Creek and Center Creek north of the facility are the recommended exposure areas for turkey hunters.

See Figure 2 from the Receptor Location Report (Appendix B) for the location of the above receptors and an indication of the general land use and land cover patterns within 10 km of the facility.

4.1.2 Acute Exposure Scenarios

Consistent with Section 4.2.7 of the HHRAP, the HHRA for the GD-OTS MS facility will assume that facility workers are protected by Occupational Safety and Health Administration (OSHA) programs, and therefore are not included in this HHRA.

Based on information contained in the Receptor Location Report (USEPA 2006a; Appendix B), acute exposure scenarios are recommended for evaluation at the following locations:

- GD-OTS MS facility property line;
- Location of maximum hourly concentration, if it occurs beyond the property line; and
- Precious Moments Park & Chapel theme park.

GD-OTS MS recommends replacing the acute exposure scenario at the facility property line with an evaluation of an acute exposure scenario at the facility QD Safety Arcs instead. QD Safety Arcs are calculated based on explosive weight at a location and the risk permitted by people not involved with the operation. Despite the fact that the QD Safety Arcs extend beyond the property line onto EMI property, no development can occur within the area and, therefore, no receptors will be present. For the GD-OTS MS facility, evaluation of a receptor at the QD Safety Arc boundary is analogous to evaluating a property line receptor since it represents the closest potential off-site receptor location.

4.3 EXPOSURE ASSUMPTIONS

Except where noted in this work plan, the equations and input parameters presented in the final HHRAP guidance (USEPA 2005a) will be used to estimate chemical concentrations in media and food sources for the standard exposure scenarios (resident, farmer, fisher). If available, exposure assumptions specific to humans that consume deer and turkey will be input into the IRAP-h View model in place of assumptions for beef and chicken ingestion pathways.

4.3.1 Exposure Pathway Summary

Chronic Exposure Pathways

Exposure via the following pathways will be evaluated for adult and child residents:

- Inhalation of vapors and particulates
- Incidental ingestion of soil
- Ingestion of drinking water from a surface water source
- Ingestion of homegrown produce

Exposure via the following pathways will be evaluated for adult and child farmers:

- Inhalation of vapors and particulates
- Incidental ingestion of soil
- Ingestion of drinking water from a surface water source
- Ingestion of homegrown produce
- Ingestion of homegrown meat and dairy products
  - Beef
  - Milk from homegrown cows
  - Chicken
  - Eggs from homegrown chickens
  - Pork

Exposure via the following pathways will be evaluated for adult and child fishers:

- Inhalation of vapors and particles
- Incidental ingestion of soil
- Ingestion of homegrown produce
- Ingestion of fish
- Ingestion of drinking water from a surface water source

Exposure via the following pathways will be evaluated for adult and child hunters:

- Inhalation of vapors and particles
- Incidental ingestion of soil
- Ingestion of deer/turkey meat

According to the Receptor Location Report (USEPA 2006a), "The drinking water intake is about 15 km southwest of the facility on Shoal Creek" (See Figure 1 of the Receptor Location Report). Standard industry practice is to model an area within 10-km of the facility. Therefore, the air modeling grid would have to be extended out to 15-km to include the drinking water intake on Shoal Creek. Significant drinking water impacts to the receptors in this study area are highly unlikely given this distance (15-km) and the fact that winds are from the south and northwest, making the drinking water intake upgradient/crossgradient from the facility. Therefore, we propose to eliminate the drinking water pathway from this HHRA.

Acute Exposure

Acute exposure will only be evaluated via the inhalation pathway.

4.4 ESTIMATION OF CHEMICAL CONCENTRATIONS IN ENVIRONMENTAL MEDIA

Equations and input parameters presented in the final HHRAP guidance (USEPA 2005a) will be used to estimate chemical concentrations in media and food sources. The HHRAP guidance provides standard conservative fate and transport and chemical-specific assumptions for each of the media and food sources of interest. As discussed, the HHRAP does not provide COPC uptake factors for deer and turkey tissue. O'Brien & Gere will develop these factors from various literature sources or by adapting the HHRAP chemical-specific parameters for chicken and beef.

For those exposure scenarios for which default fate and transport modeling parameters are not available in the HHRAP guidance (e.g., various watershed and waterbody parameters used to estimate fish tissue concentrations), site specific parameters will be derived that are consistent with the recommendations of the HHRAP. These site-specific parameters will be obtained from existing reports, U.S. Geological Survey topographic maps, and/or Natural Resource Conservation Service soil surveys. A written summary of site-specific parameters will be presented in the risk assessment report.

5. TOXICITY ASSESSMENT

The purpose of the toxicity assessment is to evaluate available information regarding the potential for Site-related COPC chemical residues of potential concern to cause adverse effects in exposed individuals. The potential toxicological effects resulting from a given dose of a chemical are classified according to two criteria, consisting of non-cancer effects (hazards) and cancer effects (risks).

5.1 HEALTH BENCHMARKS FOR LONG-TERM EXPOSURE

The HHRA for the GD-OTS MS Facility will include an evaluation of both potentially carcinogenic and non-carcinogenic COPCs. The toxicity of each COPC is based on criteria developed by regulatory bodies. Such criteria are referred to as dose-response values, and are derived for both inhalation and oral routes of exposure. The dose-response values derived by evaluation of potential carcinogenic health effects resulting from long-term exposure to COPCs are called cancer slope factors [CSFs; expressed in units of $(mg/kg\text{-}day)^{-1}$] for oral exposure pathways, and unit risk factors [URFs; expressed in units of $(ug/m^3)^{-1}$] for direct inhalation exposure pathways. The dose-response values derived for evaluation of potential non-carcinogenic health effects resulting from long-term exposure to COPC are called reference doses (RfDs; expressed in units of mg/kg-day) for oral exposure pathways and reference concentrations (RfCs; expressed in mg/m^3) for inhalation exposure pathways.

The HHRAP guidance (USEPA 2005a) includes USEPA-recommended dose-response values for more than 200 compounds historically observed to be potentially associated with hazardous waste combustion units. The HHRAP guidance also recommends a hierarchy of potential source of dose-response values from which to draw new values or values for chemicals not in the HHRAP database. For quality control purposes, at the commencement of the HHRA the published USEPA-recommended values will be checked against values currently available from the HHRAP-recommended hierarchy.

For any additional COPCs that are not specified in the guidance, available data on dose-response information will be gathered from the hierarchy of sources recommended in the HHRAP. Discussed below are three special cases for which the specification of health benchmarks is somewhat more complex.

5.1.1 Lead

USEPA has not derived RfDs for lead due to uncertainties about the health effects and dose-response associated with exposures to lead. Based on findings that neurobehavioral effects in young children occur at exposure levels below those that have caused cancer in laboratory animals, an integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children has been developed by USEPA (USEPA 2002). USEPA guidance (USEPA 2005a) has recommended the use of this IEUBK model in combustor HHRAs.

In the past, several combustor facility risk studies have yielded extremely low incremental concentrations of lead in the modeled environmental media. Those concentrations are often so low that they are difficult to evaluate in the IEUBK model (due to threshold format restrictions). Based on similar experience, USEPA Region 6 (USEPA 1998) has calculated media concentrations for lead that are protective of human health. As a conservative measure, these media concentrations were based on the USEPA benchmark (USEPA 2002) of less than 5 percent of children having blood lead concentrations exceeding 10 ug/dL. These media concentrations will be used in the HHRA to evaluate estimated concentrations of lead in soil and air.

In developing the lead screening concentrations, USEPA incorporated a margin of safety by assuming that only 25% of the allowable threshold lead level would be assigned to a particular facility. That leads to a target soil concentration of 100 mg/kg. Similarly, a target ambient air concentration for lead of 0.2 ug/m^3 is derived by the agency. USEPA also assumes that the target equals 25% of the quarterly average air concentration 1.5 ug/m^3 specified by the National Ambient Air Quality Standards (NAAQS) adjusted on an annual basis to 0.9 ug/m^3 in deriving their target concentration of 0.2 ug/m^3 for waste combustion sources like those found at the GD-OTS MS Facility.

5.1.2 Polycyclic Aromatic Hydrocarbons (PAHs)

Consistent with USEPA guidance (USEPA 2005a), the HHRA will consider both potential carcinogenic effects and non-carcinogenic toxicity for all of the polycyclic aromatic hydrocarbon (PAH) constituents measured in the comprehensive performance tests. Each potentially carcinogenic PAH is ranked in order of its potency in relation to benzo(a)pyrene. For those PAH compounds that are potentially carcinogenic, the risk analysis will use the USEPA-developed comparative potency factors to derive cancer slope factors representative of these compounds and their potential toxicity relative to benzo(a)pyrene (USEPA 1993). Potential non-carcinogenic effects of PAHs will be evaluated individually, based upon the RfD recommended by USEPA for each compound. If no RfDs are available for a PAH, the RfD for a structurally similar PAH will be used as a surrogate, and its basis will be identified in the HHRA.

5.1.3 Age Dependent Adjustment for Chemicals with Mutagenic Mode of Action

Those constituents listed in the USEPA's 2006 memorandum (USEPA 2006b) as having a Mutagenic Mode of Action (MMOA) are subject to adjustment by Age Dependent Adjustment Factors (ADAFs) as described in *Supplemental Guidelines for Assessing Susceptibility from Early Life Exposure to Carcinogens - Supplemental Guidance* (USEPA 2005b). It should be noted that other PAHs considered toxicologically related to benzo(a)pyrene, based on the *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons* (USEPA 1993), are not included on the list of chemicals with a MMOA (USEPA 2006b) but are subject to an ADAF as well.

5.1.4 Dioxin/Furans

Although there are hundreds of dioxin and furan compounds, those compounds for which potential human health impacts can be quantitatively evaluated are the dibenzodioxin, and dibenzofuran congeners which have four chlorine molecules attached in positions 2, 3, 7, and 8 on the central ring structure. Amongst these congeners, a CSF has been developed only for 2,3,7,8-tetrachloro-dibenzo-p-dioxin (2,3,7,8-TCDD). The other congeners are assigned toxicity equivalence factors (TEFs) that relate their toxicities to that of 2,3,7,8-TCDD (Van den Berg et al. 2006). This concept parallels that used for evaluating PAHs, as explained above (Section 5.1.2). Atmospheric fate and transport modeling will be carried out for each of the 17 individual dioxin and furan congeners to determine the media concentrations for modeling uptake into the food chain. The TEFs are then applied in estimating the specific risk contribution for each individual exposure scenario.

Potential carcinogenic health risks associated with the dioxin and furan congeners discussed above will be evaluated in accordance with the approach developed by USEPA, and recommended in the HHRAP as follows: Risks will be calculated for 2,3,7,8-TCDD and the dioxin and furan congeners using the cancer slope factor for 2,3,7,8-TCDD listed in HEAST (USEPA 1997), with the most recent TEFs recommended by the World Health Organization (WHO) (Van den Berg et al. 2006).

Dioxin and furan congeners may also cause some non-carcinogenic hazard. At the time of the development of the HHRAP (USEPA 2005a), no RfD was established for 2,3,7,8-TCDD. Consequently, the HHRAP guidance recommends several alternative methods to evaluate the health effects of dioxin and furan congeners. The HHRAP ends the discussion of PCDD/PCDF non-cancer hazards with the statement:

"In the future, the Agency may develop alternative approaches to evaluate noncancer effects from exposures to PCDDs and PCDFs. In that case, those approaches may be included in future risk assessments."

GD-OTS MS proposes to use the RfD selected for the establishment of the USEPA Regional Screening Levels (RSLs) (USEPA 2012) to calculate non-carcinogenic hazard from these compounds.

5.2 HEALTH BENCHMARKS FOR SHORT-TERM EXPOSURE

As currently required by USEPA, it will be necessary to evaluate risks due to short-term inhalation exposure (such as irritant or respiratory health effects) in addition to the more commonly evaluated chronic risks to human health discussed above. Therefore, a screening level evaluation of short-term health effects will be conducted by comparing predicted short-term (maximum 1-hour) air concentrations against applicable guidelines.

The short-term ambient air concentration guidelines, summarized by hierarchical preference, include:

- California EPA Acute Reference Exposure Levels (Cal/EPA 1999);
- Acute inhalation exposure guidelines (AEGL-1) (USEPA 2001);
- Level 1 emergency planning guidelines (ERPG-1; DoE 2001; SCAPA 2001);
- Temporary Emergency Exposure limits (TEEL-1; DoE 2001; SCAPA 2001); and
- AEGL-2 values (USEPA 2001).

6. RISK CHARACTERIZATION

Risk characterization is the final step of the risk assessment. It is defined as the combination of the exposure assessment and toxicity assessment to produce an estimate of risk and a characterization of uncertainties in the estimated risk.

6.1 NON-CARCINOGENIC HAZARD

The potential for chemicals to cause adverse non-carcinogenic health effects will be assessed by dividing estimated exposure doses (determined for the exposure scenarios described in Section 4) by appropriate dose-response values, such as RfDs, derived by the USEPA. The resulting ratio is referred to as the "chemical-specific risk ratio" or hazard quotient. For individual chemicals, hazard quotients (HQs) will be added across exposure pathways to determine the total non-carcinogenic hazard index (HI) for each receptor potentially exposed to facility-related COPC in the environment.

The USEPA has determined that exposure to a chemical is not expected to cause significant adverse health effects if this total risk ratio, or HI, for all exposure pathways has a total value of 1.0 or less. The relevant USEPA risk management guidance (USEPA 1998) describing management decisions for combustion facilities recommends, however, that it be assumed that 75% of this value is reserved for exposures that may come from other background sources. Thus, the guidance indicates that an HI of 0.25 should serve as an initial screening benchmark for exposures that may be associated with the subject facility operations -- unless a further effort is undertaken to better understand the current and future background conditions, and their relationship to facility emissions.

Since a total HI of less than or equal to 1.0 generally indicates no significant risk of adverse non-carcinogenic human health effects, the more conservative benchmark of 0.25 would also support such a conclusion. The USEPA further recommends that if the resulting summation exceeds 0.25, the HI analysis should be re-examined and refined, such that only those chemicals exhibiting the same or similar toxicity endpoints (i.e., target organs) are summed. Since chemicals may display a variety of effects depending on concentration, the toxic endpoint is defined in this context as the most sensitive non-carcinogenic health effect used to derive the reference dose.

6.2 CANCER RISK

Potential incremental ("excess") lifetime cancer risks will be calculated for each receptor by multiplying the appropriate CSF by the site-specific exposure dose level determined for each of the exposure scenarios described in Section 4.0. The cancer risks from each carcinogenic COPC and from each exposure pathway will be added together to estimate the total cancer risk for each receptor. The USEPA risk management guidance (USEPA 1998) suggests a target risk level of 1×10^{-5} as an acceptable total for all contributions of carcinogenic risk at a designated individual receptor. If the total carcinogenic risk is less than 1×10^{-5}, then it is assumed that the risks are generally inconsequential and no further analysis is necessary.

If the initial HHRA results meet both of the above cancer risk and non-cancer hazard index criteria, no further analysis is presumed to be necessary.

6.3 RISKS DUE TO SHORT-TERM EXPOSURE

In addition to the potential long-term risks and hazards to human health presented by COPCs emitted from the facility, short-term or acute risk will be evaluated for direct inhalation of vapor phase and particle phase COPCs. Acute exposure will be estimated, based on maximum one-hour average air concentrations predicted from the atmospheric dispersion and deposition modeling described in Section 3. To determine the likelihood of adverse acute effects, maximum predicted one-hour average air concentrations will be compared to criteria for short-term inhalation exposures, resulting in an acute HQ.

6.4 UNCERTAINTY ANALYSIS

Estimation of risks to human health that may result from exposure to constituents in the environment is a complex process. Each assumption used in estimating cancer risks and non-cancer hazards, whether it is the toxicity value for a particular chemical or the value of a parameter in an exposure equation, has a degree of variability and uncertainty associated with it. In each step of the risk assessment process, beginning with the data collection and analysis and continuing through the toxicity assessment, exposure assessment, and risk characterization, conservative assumptions are made that are intended to be protective of human health and to ensure that risks and hazards are not underestimated.

The risk and hazard values generated in this HHRA will not be precise, deterministic estimates, but conditional estimates controlled by conservative upper-bound assumptions regarding exposure and toxicity. The calculated risk values will provide an upper bound of the potential health risk value, as opposed to a precise estimate of actual health risks. The section will provide a thorough discussion of the uncertainties associated with the HHRA and how each of these uncertainties can impact the risk and hazard estimates.

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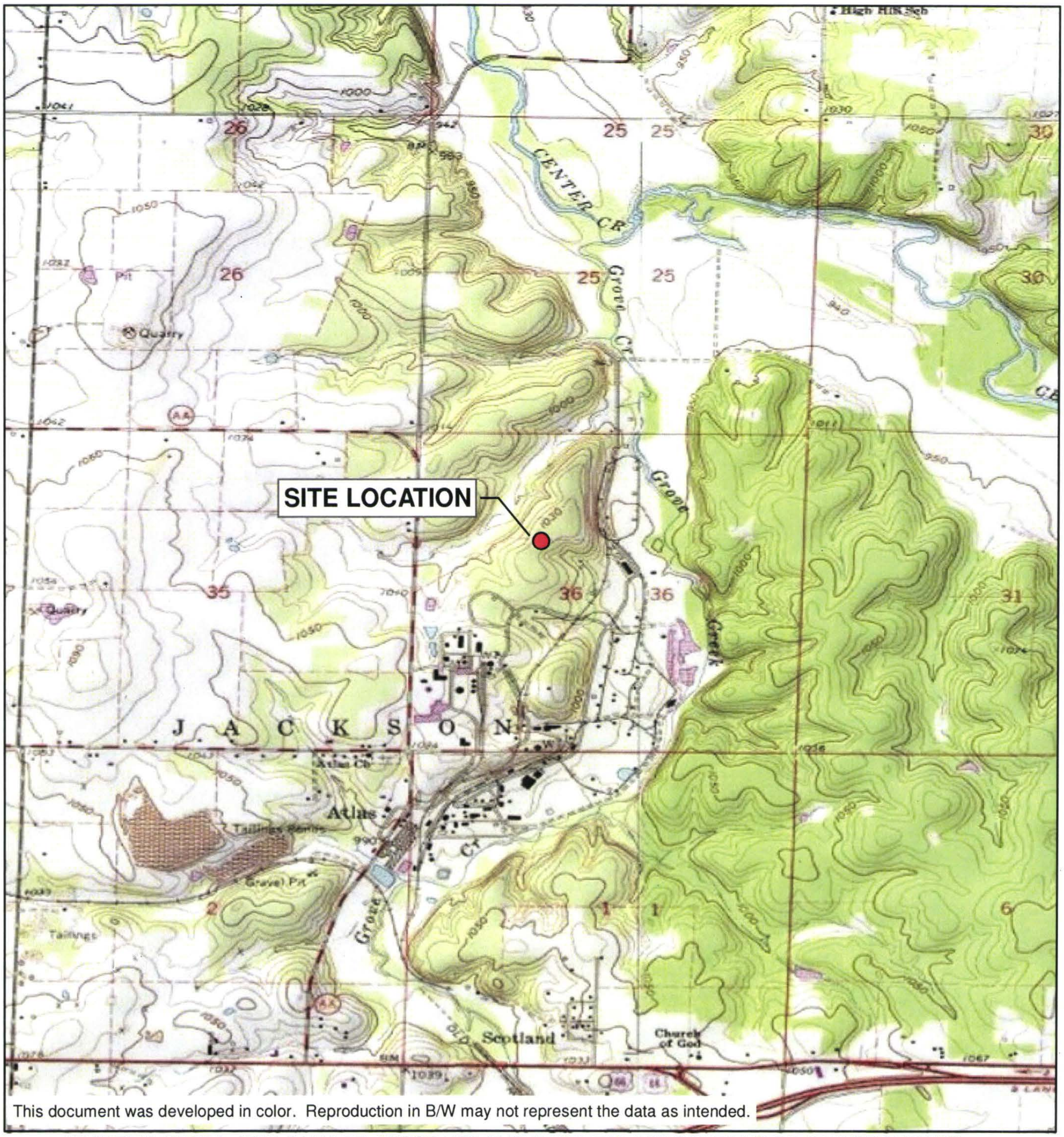
PLOTDATE: 9/5/2012 MLS



ADAPTED FROM: JOPLIN EAST, MISSOURI AND FIDELITY, MISSOURI USGS QUADRANGLES

GENERAL DYNAMICS
OTS MUNITIONS FACILITY
JOPLIN, MISSOURI

MAP LOCATION

N

FIGURE 1
SITE LOCATION

0 1,250 2,500 5,000 7,500 10,000
Feet

SEPTEMBER 2012
49516

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O'BRIEN & GERE

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GENERAL DYNAMICS
OTS MUNITIONS FACILITY
JOPLIN, MISSOURI

FIGURE 2
AERIAL PHOTOGRAPH

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0 1,000 2,000 4,000 6,000 8,000
Feet

SEPTEMBER 2012
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1:30,000

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GENERAL DYNAMICS
OTS MUNITIONS FACILITY
JOPLIN, MISSOURI

FIGURE 3
FACILITIES DETAIL

0 150 300 600
Feet

N

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SEPTEMBER 2012
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USEPA (Tetra Tech) Comments on the 2008 HHR Work Plan

TECHNICAL REVIEW COMMENTS
HUMAN HEALTH RISK ASSESSMENT WORK PLAN
EBV EXPLOSIVES ENVIRONMENTAL COMPANY
JOPLIN, MISSOURI

Tetra Tech EM Inc. (Tetra Tech) received Region 7 Task Order No. R719-15 from the U.S. Environmental Protection Agency (EPA) under Contract No. EP-W-07-019 (Resource Conservation and Recovery Act [RCRA] Enforcement and Permitting Assistance) to provide assistance to RCRA staff in EPA Region 7. Under Task 3 of the work assignment, EPA Region 7 has requested that Tetra Tech review the Human Health Risk Assessment Work Plan for the EBV Explosives Environmental Company (EBV), Joplin, Missouri. The work plan was prepared by ENSR Corporation and is dated July 2008. The objective of the review is to provide detailed comments on the work plan—(1) identifying where the work plan deviates from EPA guidance and whether those deviations will render the resultant risk assessment unsuitable for use in evaluating risk, and/or (2) detailing issues with the work plan and steps necessary to resolve those issues. Tetra Tech's general and specific comments on this document appear in the following sections.

GENERAL COMMENT

1. The human health risk assessment (HHRA) work plan generally follows EPA combustion risk assessment guidance. Several issues on the HHRA work plan that require further clarification are addressed in the specific comments section.

SPECIFIC COMMENTS

1. **Section 2.2.1, Page 2-3, Paragraph 1, First Bullet**. The metals to be analyzed in the exhaust gas do not include antimony. However, antimony is identified earlier in this section as a major constituent in the waste to be processed in the Contained Thermal Treatment Facility (CTTF). Antimony must be included in the metals to be analyzed in the exhaust gas.

2. **Section 2.3.1, Page 2-4, Paragraph 2**. This section describes the emission rates for the CTTF. Section 2.3.1 notes that operational data will be reviewed to determine the value to assign as an "upset adjustment factor." This section should reference the discussion in Section 2.3.2 for the explanation of how this factor will be determined.

3. **<u>Section 2.3.1, Page 2-4, Paragraph 3</u>**. The methods to be used for estimating emissions of undetected chemicals are described in this section. The reference(s) for these methods should be provided.

4. **<u>Section 2.3.2, Page 2-4, Paragraph 6</u>**. This section states that data generated during the first months of operation will be used to determine an "upset factor." The work plan should either provide a methodology/protocol for this determination or provide a reference to a methodology/protocol that will be followed.

5. **<u>Section 3.0, Page 3-1, Paragraph 1</u>**. This section indicates that the modeling will be conducted according to the AERMOD model, Version 04300. The modeling analysis should be conducted using the most recently approved version of AERMOD, which is Version 07026.

6. **<u>Section 3.2, Page 3-2, Paragraph 2</u>**. The meteorological dataset planned for the analysis is not the most representative data available for the facility. The work plan states that surface data will be obtained from St. Louis, Missouri, to be consistent with the 1995 risk assessment. The 1995 risk assessment prepared by IT Corporation used 1989-1993 meteorological data from Springfield and Monet, Missouri. It has been 14 years since the 1995 risk assessment, and a different dispersion model will be used with different meteorological data requirements. Moreover, St. Louis is approximately 250 miles from Joplin, along the Mississippi River. For these reasons, the meteorological dataset should be revised to include surface and precipitation data from a more representative station such as Springfield and Monet, Missouri.

7. **<u>Section 3.2, Page 3-2, Paragraph 3</u>**. The work plan indicates that surface characteristics (albedo, surface roughness, and Bowen ratio) will be identified for AERMET processing but does not describe how these important data elements will be determined. The work plan should describe the method by which the surface characteristics will be identified. EPA recommends use of a new EPA tool called AERSURFACE to identify these surface characteristics (EPA 2009).

8. **<u>Section 4.1, Page 4-1, Paragraph 4</u>**. The text notes that Missouri American Water Company does not provide drinking water to the site; however, the work plan does not identify the source of drinking water at the site. This information should be provided in the work plan.

9. **Section 4.1, Page 4-1, Paragraph 4 and Section 4.2, Page 4-3, Paragraph 1**. The text notes that additional information necessary for estimating uptake into deer and turkey will be obtained from the literature. The text does not identify the specific information to be obtained. If information specific to deer and turkey is limited, the HHRA should start with available default values derived for beef and chicken (or other birds), and then substitute deer and turkey values if these become available.

10. **Section 4.3, Page 4-4, Paragraph 6**. The text notes that site-specific refinements to the procedures for estimating chemical concentrations in environmental media will be considered. Suggestion is to submit any changes of default parameters to EPA for review and approval before use. This should reduce the possibility that rerunning the model will be necessary because of disagreements regarding input parameters.

11. **Section 5.1.2, Page 5-2, Paragraph 2**. This section identifies the approach for addressing the toxicity associated with polycyclic aromatic hydrocarbons (PAH). It does not address recent EPA guidance on addressing mutagenic carcinogenic compounds (EPA 2005), which include several PAHs. This guidance must be incorporated into the dose assessment and subsequent risk characterization of these compounds.

REFERENCE:

U.S. Environmental Protection Agency (EPA). 2005. "Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens." Risk Assessment Forum. EPA/630/R-03/003F. March. On-line Address: http://cfpub.epa.gov/ncea/raf/recordisplay.cfm?deid=160003

EPA. 2009. "AERMOD Implementation Guide." AERMOD Implementation Workgroup, EPA Office of Air Quality Planning and Standards. March 19

Receptor Location Report

EBV EXPLOSIVES ENVIRONMENTAL COMPANY
JOPLIN, MISSOURI

REACTIVE WASTE INCINERATOR HUMAN HEALTH RISK ASSESSMENT
FINAL RECEPTOR LOCATION REPORT

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
901 N. 5th Street
Kansas City, Missouri 66101

Work Assignment No.	:	R07103
EPA Region	:	7
Date Prepared	:	September 15, 2006
Contract No.	:	68-W-02-021
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CONTENTS

FIGURES

ACRONYMS AND ABBREVIATIONS

APCS	Air pollution control system
COPC	Chemical of potential concern
DOI	U.S. Department of the Interior
EBV	EBV Explosives Environmental Company
EMI	Expert Management, Inc.
EPA	U.S. Environmental Protection Agency
g/kg-day	Grams per kilogram body weight per day
HHRA	Human health risk assessment
HHRAP	Human Health Risk Assessment Protocol
IRAP-h View	Industrial Risk Assessment Program-Health View
kg	Kilograms
km	Kilometer
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
RCRA	Resource Conservation and Recovery Act
Tetra Tech	Tetra Tech EM Inc.
USDA	U.S. Department of Agriculture

1.0 INTRODUCTION

Tetra Tech EM Inc. (Tetra Tech) received work assignment No. R07103 from the U.S. Environmental Protection Agency (EPA), under Contract No. 68-W-02-021, to provide assistance to Resource Conservation and Recovery Act (RCRA) state and federal program staff in EPA Region 7. EPA requested that Tetra Tech assist in preparing a human health risk assessment (HHRA) of the emissions from the EBV Explosives Environmental Company (EBV) facility in Joplin, Jasper County, Missouri. Specifically, Tetra Tech will assist EPA in preparing an HHRA by (1) completing air dispersion and deposition modeling for emissions from the EBV incineration plant stack, (2) identifying receptor locations to evaluate in the HHRA, and (3) building the Industrial Risk Assessment Program-Health View (IRAP-h View) software project. This final report on receptor locations is submitted under Task 3 of Tetra Tech's work plan.

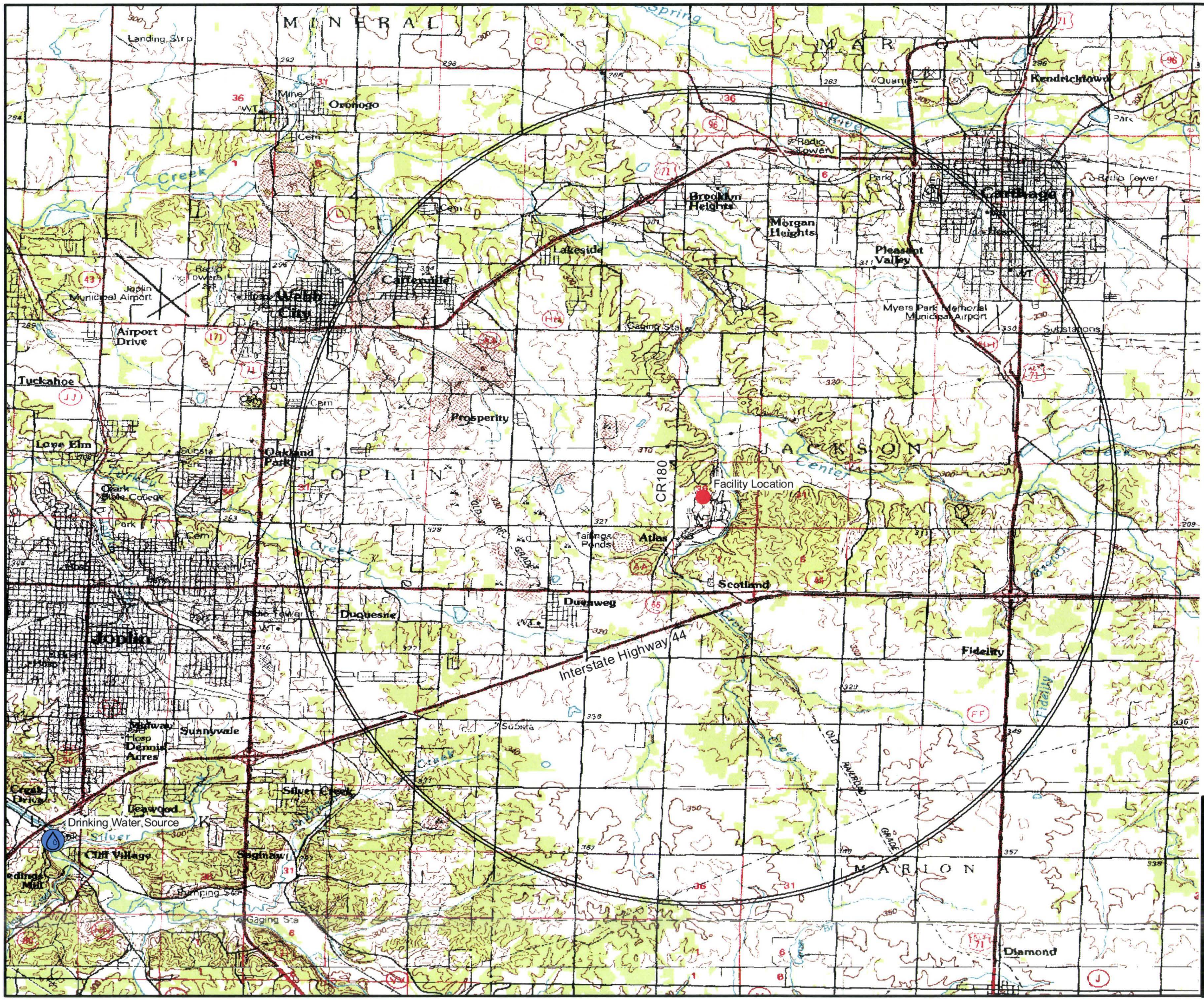
1.1 BACKGROUND

EBV is located in rural Jasper County, Missouri, on County Road 180 about 3 kilometers (km) north of U.S. Interstate 44 (Figure 1). The region includes the Oronogo-Deunweg Mining Belt Superfund Site, part of the Tri-State Mining District that was an active zinc-lead mining area until 1957 (MDNR/DOI undated). Today, there are subsidence ponds, waste rock piles, and tailings and chat piles throughout the area. The site is about 4 km northwest of the City of Duenweg, 8 km southwest of the City of Carthage, and 10 km east of the City of Joplin. The EBV facility, which was constructed in 1994, treats reactive waste generated by the explosives manufacturing industry, users of explosive devices and materials, and government agencies. EBV operates under EPA Identification Number MOD985798164 and Missouri Hazardous Waste Management Facility Treatment and Storage Permit Number MOD985798164. The HHRA will be used to support permitting of the facility.

1.2 PURPOSE AND OBJECTIVES

This final report on receptor locations documents the receptor exposure scenarios and receptor locations selected for the EBV HHRA. Receptors and receptor locations were identified following the guidance in EPA's "Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities" (HHRAP; EPA 2005). The report meets the following objectives:

- Characterization of facility and exposure setting
- Identification of water bodies and watersheds within the assessment area



N

0 1 2 4
Kilometers

Legend

- Facility Location
- Drinking Water Source
- 10 Kilometer Radius

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FIGURE 1
SITE LOCATION MAP

TETRA TECH EM INC.

- Selection of appropriate exposure scenarios
- Identification of locations for each exposure scenario

Recommended locations for evaluating the exposure scenarios identified in this report are subject to change after the air dispersion modeling output (plot files) is reviewed and locations of maximal air concentrations and depositions for compounds of potential concern (COPC) are identified. The IRAP-h View project, which is built starting with the air dispersion modeling output, will import air parameters associated with specific receptor grid nodes. These nodes are defined as the Universal Transverse Mercator coordinates for receptors evaluated in the air dispersion modeling, corresponding to the location of each exposure scenario. The receptor grid nodes imported into the IRAP-h View project will be based on the recommended receptor locations, the magnitude of air parameter values corresponding to these locations, and available site-specific information.

2.0 METHODS

Tetra Tech reviewed available information about EBV and land use in the assessment area (within 10 km of the facility) to develop a preliminary list of receptor locations. Tetra Tech then conducted a reconnaissance to evaluate the preliminary list of locations and finalize the list for the HHRA. In addition, Tetra Tech reviewed other sources of information to compile the basic information needed to characterize the facility and exposure setting.

2.1 FILES REVIEWED

Tetra Tech reviewed the following files for information needed to characterize the facility and exposure setting:

- Facility layout maps
- Installation layout maps
- Topographical maps
- Land use/land cover maps
- Meteorological data
- EBV RCRA permit application (EBV 2001)

- Information available on the World Wide Web

2.2 SITE RECONNAISSANCE

Tetra Tech performed a reconnaissance of the land uses in the assessment area on August 23, 2006. The reconnaissance evaluated land uses relevant to the EPA (2005) exposure scenarios and identified specific locations that would correspond to the scenarios. The EPA (2005) exposure scenarios are resident, resident child, farmer, farmer child, fisher, fisher child, which are chronic scenarios; and the acute receptor, which is a short-term inhalation scenario. Locations for additional non-EPA recreational exposure scenarios were also evaluated.

The EBV facility is situated in the Atlas Industrial Park, located between County Road 180 and Grove Creek, which flows north and discharges into Center Creek approximately 6 km north of the facility (Figure 1). The main entrance to the industrial park was gated and manned with a security guard; Tetra Tech did not attempt to gain access. The EBV offices are located adjacent to the main entrance. The gate at an entrance at the northern end of the park was locked. This gate accesses the road to the waste storage units (magazines), the storage/feed handling building, and the incineration plant.

Tetra Tech traveled around the perimeter of the industrial park to identify near-field receptor locations. Once these features were evaluated, Tetra Tech inspected features within 10 km of the facility. Figures that depict air quality isopleths were used to evaluate locations that correspond to elevated short-term and long-term air concentrations and depositions. Observations made by Tetra Tech during the site reconnaissance are incorporated into discussions of exposure setting and the identification of exposure scenarios and representative receptor locations.

3.0 FACILITY AND EXPOSURE SETTING CHARACTERIZATION

Information about the facility and the exposure setting was compiled to characterize the activities at the facility and identify exposure scenarios and receptors for the HHRA. This information is presented below.

3.1 FACILITY CHARACTERIZATION

The EBV facility is located at 3078 County Road 180 in Joplin, Missouri. EBV operates an incineration complex to service the explosive manufacturing industry, government agencies such as the U.S.

Department of Defense, and other firms that produce materials that are considered reactive or explosive. Most waste received at the facility is off-specification explosives or explosive-containing devices, pharmaceuticals that contain explosives, riot control materials, ammunition, and propellants. Residual wastes from spill cleanups, plant manufacturing wastes, and related explosive industry wastes are also accepted (EBV 2001).

The EBV facility encompasses 55 acres at the northern end of the Atlas Industrial Park, which includes other tenants. The facility consists of 14 structures or areas. The principal areas include the magazine area, the storage/feed handling building, and the incineration plant. The incineration complex includes two primary combustion devices — a rotary kiln and a car bottom furnace — to treat waste feed that comes to the facility as solids, liquids, slurries, and solids packed in liquids. The rotary kiln is the principal incinerator used for the majority of the waste received at the facility. It is used to decontaminate large items and drums and burn explosives-contaminated material. The furnace is used to detonate fuzes, ammunition, and detonators. A secondary combustion chamber treats flue gas from the kiln and furnace. The combustors are natural gas-fired. The air pollution control system (APCS) consists of a spray dryer that quenches the gas and removes acid gases and particulates, and baghouses that also remove particulates from the flue gas stream.

Metal casings and bottom ash from the primary combustion chambers and residues from the spray dryer and baghouses are collected, stored on site, and then shipped to a waste disposal facility. The building is vented to the secondary combustion chamber located in the APCS to prevent fugitive emissions from escaping (EBV 2001). Emissions are vented to the atmosphere through a stack that is 65 meters high. The most recently available information on stack emissions was collected during a trial burn in 1995 (MRI 1995); the data that were used to prepare a risk assessment (ICF Kaiser 1995) at that time will also be used to build the current IRAP-h View project. COPCs with emission rates include metals and volatile organic compounds.

3.2 EXPOSURE SETTING

The EBV facility is located in rural Jasper County, Missouri, about 4 km northeast of the City of Duenweg. The land uses in Jasper County include unaltered natural land (mixed forest land and mixed rangeland), mining-related, urban, and arable agriculture (mainly wheat, sorghum, corn, soybeans, and hay) (MDNR/DOI undated). Elevations in Jasper County range from 1,200 feet near the southeast corner of the county to 826 feet in the western part, where the Spring River exits the county. Drainage is generally to the west (United States Department of Agriculture [USDA] 2004). The total annual average precipitation is about 43.22 inches, and average annual temperatures range from 35.2 °F in winter to 77.6 °F in summer (USDA 2004). Wind direction is predominantly from the south and northwest (USDA 2004).

The reconnaissance evaluated land uses within a 10-km radius of the facility, which corresponds to the extent of the receptor grid used for the air dispersion modeling. Characterization of the exposure setting focuses on a 3-km radius from the facility because the highest concentrations and depositions of COPCs will occur in this area. There are numerous small farms, a few small residential areas, isolated residences, and two creeks within this distance from the facility. The drinking water intake is about 15 km southwest of the facility on Shoal Creek (Figure 1). The Missouri American Water Company supplies drinking water to EBV and the Cities of Duenweg and Joplin (Tetra Tech 2006). The only areas of standing water observed within 3 km of the site were tailings ponds. No special subpopulations, such as schools, retirement homes, and daycare facilities, were identified within 3 km of the facility. Locations of schools in the Cities of Deunweg, Carthage, Carterville, and Webb City were noted on land use maps and confirmed during the reconnaissance. The nearest schools are Deunweg Elementary School, about 4 km from the site, and Steadley Elementary School on the southwest outskirts of Carthage, about 7 km from the EBV site.

The sections below characterize the exposure setting in terms of receptors and receptor locations that are appropriate for the HHRA: (1) farmer scenario, (2) resident scenario, (3) fisher scenario, (4) acute scenario, and (5) recreational hunter scenarios.

3.2.1 Receptors for the Farmer Scenario

The reconnaissance indicated that pasture/natural land was the most prevalent land cover in the assessment area; however, few pastured livestock were observed, which suggests that small farms generally are used as residences only. One small (less than 10 head) herd of beef cattle was observed grazing at a farm about 5 km northwest of the facility, and a small herd of young dairy cattle was noted at a farm about 3 km northeast of the facility. Two hay fields were also located 3 km north of the facility, and bales of hay were observed on several other farms farther from the facility. No aboveground crops were observed in the assessment area. However, information indicates that wheat, sorghum, corn, and soybeans, in addition to hay, are grown in Jasper County (MDNR/ DOI undated).

The available information indicates that the HHRA should evaluate both current and reasonable potential future farmer scenarios. Current scenarios are appropriate for the locations where hay is grown and where the dairy cows and beef cattle were observed. Pasture land is situated west of the facility across County Road 180; although there was no evidence that livestock are currently pastured there, the location could be used in the future. Therefore, a farmer scenario should be evaluated for that location to assess reasonable potential future health risks.

3.2.2 Receptors for the Resident Scenario

Small farms and residences are scattered throughout the area around the facility. The nearest residence was observed about 1 km northwest of the facility, at the intersection of County Road 180 and Dogwood Road. Residences are also situated about 2 km east of the facility, off Chapel Road, and 3 km west-southwest of the facility, on Prigmor Avenue in Deunweg. Vegetable gardens were not observed at these residences.

The community of Scotland, population unknown, is situated about 1.5 km south of the facility. Scotland is composed of about 30 private residences and one commercial facility at the north end of the town. The City of Deunweg, population 1,034, is about 4 km southwest of the facility. The Town of Prosperity, population unknown, is located about 3 km northwest of the facility.

This information indicates that the three individual residences and three population centers should be evaluated as current residential scenarios. The reconnaissance also noted properties along County Road 180 where structures, such as homes and schools, formerly stood. The HHRA should evaluate a reasonable potential future resident scenario in the event that a new home is constructed along this road.

3.2.3 Receptors for Fisher Scenario

Grove Creek is a shallow, slow-moving creek that runs behind the Atlas Industrial Park. The Missouri Department of Conservation (MDC 2006) web site indicates that designated uses for Grove Creek include human health fish consumption, and MDNR/DOI (undated) noted that fish were seen in Grove Creek behind the EBV site. The reconnaissance could not access the creek by automobile. Although it is uncertain whether this water body is fished, the HHRA should assume that it is fished and, therefore, a fisher scenario should be evaluated for the reach behind the facility.

Grove Creek discharges into Center Creek about 2 km downstream of the EBV site. MDC indicates that the designated uses for Center Creek include cool water fishery and that bass fishing occurs on Center Creek. Therefore, a fisher scenario should be evaluated for Center Creek.

3.2.4 Receptors for the Acute Scenario

Several other companies are situated at the Atlas Industrial Park, including Expert Management, Inc. (EMI), which manufactures commercial explosives. This company formerly was ICI Explosives USA Inc., which formerly owned and operated the EBV facility. Five other companies occupy the industrial park, including Crazy Debbie's Fireworks, a fireworks manufacturer; Atlas Warehouses LLC, a warehousing operation that is based in Deunweg; McFarland Cascade Inc., a wood products manufacturer based in Seattle, Washington; Jordan Disposal Services, LLC, a refuse transporter; and R and R Trucking, an explosive waste transporter. (The company information was found on the World Wide Web.) Evaluation of the air modeling output indicates that building downwash is not significant. Based on this information, an acute scenario should be evaluated at the EBV property line to evaluate potential short-term adverse health effects associated with emissions from the EBV incinerator. If maximum hourly COPC concentrations occur farther than the fenceline, the corresponding location should also be evaluated to ensure potential future acute exposures are addressed.

The Precious Moments Park & Chapel theme park is located about 4 km east-northeast of the site. The park represents a land use feature that is potentially culturally important to southwest Missouri. Therefore, the HHRA should evaluate the acute scenario at this location.

Exposures by EBV workers are expected to be negligible because the air modeling indicated that buildings at the site do not meet the criteria for downwash, which would result in elevated COPC concentrations on the EBV site. Therefore, an acute scenario should not be evaluated for an on-site worker. The IRAP project should be used to verify this assumption. If the IRAP project indicates that hourly COPC concentrations are elevated on-site, then an acute scenario should be evaluated at the location of the maximal concentrations.

3.2.5 Receptors for Recreational Hunter Scenarios

MDC regulates recreational turkey and deer hunting in Jasper County during the autumn. Therefore, turkey and deer hunting scenarios should be evaluated in the HHRA. Turkey are hunted in open fields and cropland, while deer are hunted on a variety of land uses, including fields, cropland, mixed forest land, and river bottoms. These two scenarios should be evaluated for mixed forest land and agricultural land associated with maximum depositions from the facility because information about specific hunting locations was not available. Specific locations will be identified after review of the air modeling results.

4.0 IDENTIFICATION OF EXPOSURE SCENARIOS AND RECEPTOR LOCATIONS

This section identifies the exposure scenarios and representative receptor locations for each exposure scenario that should be evaluated in the HHRA. Information collected during the file review and observations made during the site reconnaissance are incorporated into this section. The EPA-recommended exposure scenarios include (1) a resident scenario (adult and child), (2) a farmer scenario (adult and child), (3) a fisher scenario (adult and child), and (4) an acute inhalation scenario. Site-specific conditions warrant the addition of the recreational hunter scenarios to the four EPA-recommended exposure scenarios. Polychlorinated dibenzo(p)dioxins and polychlorinated dibenzofurans are not COPCs. Therefore, infant ingestion of mother's breast milk will not be evaluated.

The highest unitized air parameter values corresponding to each location will be used to calculate air concentrations and soil depositions for each exposure scenario location evaluated. Watershed inputs and concentrations in water bodies will be calculated following the recommendations in the HHRAP.

4.1 EPA-RECOMMENDED EXPOSURE SCENARIOS

The following sections provide (1) an overview of the exposure scenarios recommended by EPA (2005), (2) a comparison of the EPA-recommended exposure scenarios to actual scenarios identified in the assessment area, and (3) the locations of the representative exposure scenario. Exposure factors for the exposure scenarios are listed in Table A-1 in Appendix A. Those for the resident, farmer, and fisher scenarios are recommended by EPA (2005) and for other scenarios are based on available information.

4.1.1 Resident and Resident Child Exposure Scenario

The pathways for the resident exposure scenario account for potential exposures in an urban or nonfarm rural setting. This scenario evaluates potential exposures through ingestion of homegrown produce, among other pathways. The scenario assumes the resident is exposed to COPCs through:

- Inhalation of vapors and particulates
- Incidental ingestion of soil
- Ingestion of drinking water from a surface water source
- Ingestion of homegrown produce

The primary differences between the adult resident and child resident are in exposure duration and consumption rates for homegrown produce.

The resident scenario will be evaluated for seven locations listed below and shown on Figure 2, as follows:

- Residence at the southwest corner of County Road 180 and Dogwood Road (Current CR 180 Resident)
- Residence on Chapel Road (Chapel Road Resident)
- Residence on Prigmor Avenue (Prigmor Avenue Resident)
- Community of Scotland (Scotland Resident)
- City of Deunweg (Deunweg Resident)
- City of Prosperity (Prosperity Resident)
- Resident across County Road 180 (Potential Future CR 180 Resident)

A reasonable potential future resident scenario will also be evaluated at the off-site location with the highest estimated soil concentration to ensure that potential exposures for a future resident are not underestimated.

The main difference between the pathways for the EPA-recommended scenario and those for actual residences in the assessment area is uncertainty about whether residents consume homegrown produce. The EBV HHRA will assume that homegrown produce is consumed at each of the locations.

4.1.2 Farmer and Farmer Child Exposure Scenario

The subsistence farmer exposure scenario will be evaluated in the HHRA to account for the combination of exposure pathways a receptor may be exposed to at the rural farms located around the periphery of the facility. The farmer scenario evaluates potential exposures through ingestion of homegrown produce, among other pathways. The scenario assumes the resident is exposed to COPCs through:

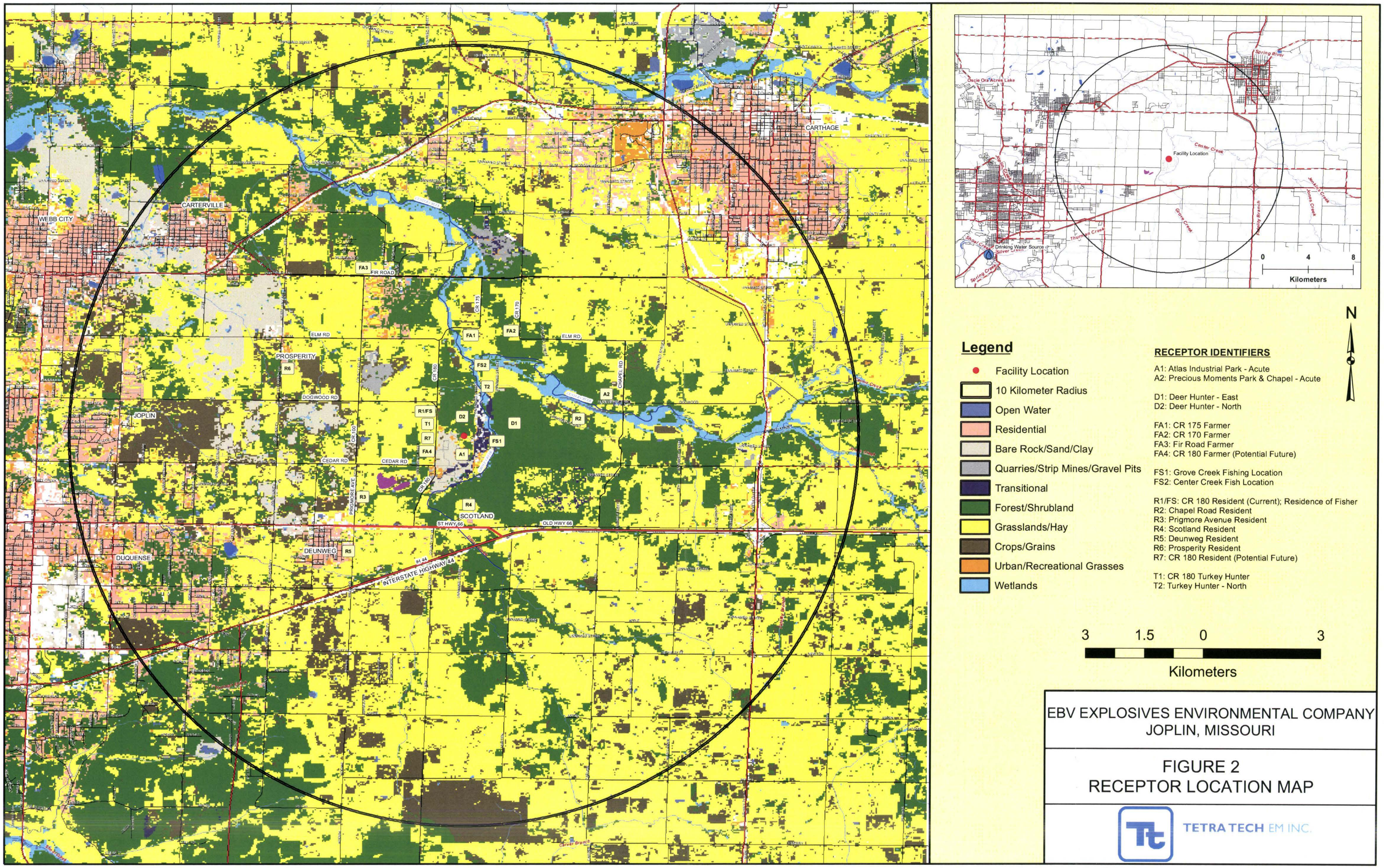

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FIGURE 2
RECEPTOR LOCATION MAP

TETRA TECH EM INC.

- Inhalation of vapors and particulates
- Incidental ingestion of soil
- Ingestion of drinking water from a surface water source
- Ingestion of homegrown produce
- Ingestion of homegrown meat and dairy products
  - Beef
  - Milk from homegrown cows
  - Chicken
  - Eggs from homegrown chickens
  - Pork

The primary differences between the adult farmer and child farmer are in exposure duration and consumption rates for homegrown produce.

The farmer scenario will be evaluated for four locations listed below and shown on Figure 2, as follows:

- Hay fields about 3 km north of the facility on County Road 175 (Current CR 175 Farmer)
- Pastured dairy cows on County Road 170 (Current CR 170 Farmer)
- Pastured beef cattle at the intersection of County Road 190 and Fir Road (Current Fir Road Farmer)
- Potential future location across County Road 180 (Potential Future CR 180 Farmer)

A reasonable potential future farmer scenario will also be evaluated at the off-site location with the highest estimated soil concentration to ensure that potential exposures for a future farmer are not underestimated.

4.1.3 Adult and Child Fisher Exposure Scenario

The fisher exposure scenario will be evaluated in the HHRA to account for the combination of exposure pathways a receptor may be exposed to in rural settings where fish may be a main component of the receptor diet. The fisher is assumed to be exposed to COPCs emitted from the facility through the following exposure pathways:

- Inhalation of vapors and particles

- Incidental ingestion of soil
- Ingestion of homegrown produce
- Ingestion of fish
- Ingestion of drinking water from a surface water source

The fish ingestion pathway will be evaluated separately for Grove Creek and Center Creek based on maximum COPC deposition rates corresponding to these water bodies and their watersheds. The fisher and fisher child will be assumed to reside at (1) the location of the current CR 180 resident, and (2) the off-site location corresponding to the highest estimated soil concentration, which will ensure that potential exposures for a fisher residing at this location are not underestimated. Therefore, fisher scenarios will be evaluated for current and future residents fishing at Grove Creek, and for current and future residents fishing at Center Creek.

4.1.4 Acute Risk Exposure Scenario

Short-term (or acute) effects are evaluated based on maximum 1-hour inhalation of vapor-phase and particle-phase COPCs. Acute risk will be evaluated for human receptors at the Atlas Industrial Park based on maximum hourly "fenceline" concentrations at the EBV facility; if the maximum hourly concentrations occur farther that the fenceline, that location should also be evaluated. Acute risk will also be evaluated at the Precious Moments Park & Chapel based on maximum hourly concentrations corresponding to that location.

4.2 ADDITIONAL EXPOSURE SCENARIOS

Site-specific activities that occur in the assessment area, such as recreational hunting, warrant the evaluation of additional exposure scenarios in the HHRA. The additional exposure scenarios include (1) a recreational deer hunter exposure scenario, and (2) a recreational turkey hunter exposure scenario. A recreational fisher exposure scenario will not be evaluated because the fisher scenario will present higher exposures and, therefore, will be protective of a recreational fisher. The following sections discuss (1) the additional exposure scenarios and associated exposure pathways, (2) the representative receptor locations for each exposure scenario locations, and (3) receptor-specific exposure parameter values selected for each additional exposure scenario.

4.2.1 Recreational Deer Hunter Exposure Scenario

White-tailed deer is a popular regional game species. An adult recreational deer hunter exposure scenario will be evaluated in the HHRA to account for the exposure pathway of ingestion of deer meat eaten throughout the year. A child recreational deer hunter exposure scenario will not be evaluated because of the lack of data on the consumption rate of game meats for children. The deer hunter scenario assumes exposure to COPCs only through ingestion of deer meat from game taken at locations near the facility. Air modeling receptor points corresponding to deer hunting habitat will be selected after review of the air modeling output. The nearest woodland areas were selected as representative locations assuming that deer forage in any forested area near EBV. Preliminary locations include wooded habitat north and east of the facility shown on Figure 2.

Default exposure parameter values for adult body weight, exposure duration, and averaging times presented in EPA (2005) for the adult resident exposure scenario will be used to evaluate the deer hunter exposure scenario (see Appendix A). The exposure frequency value will be set equal to 365 days per year because the recreational deer hunter is assumed to consume meat taken throughout the year. The *Exposure Factors Handbook* (EPA 1997) was consulted for an ingestion rate value for the adult deer hunter. Values presented in Table 11-6 of the *Exposure Factors Handbook* ("Per Capita Intake of Game") for game meats were evaluated (in grams per kilogram body weight per day [g/kg-day], as consumed). The most conservative (highest) mean intake by locale (0.019 g/kg-day for nonmetropolitan areas) was selected for the HHRA. The selected consumption rate corresponds to a mass of 0.00133 kilograms (kg) deer meat per day by multiplying by the EPA standard adult body weight of 70 kg (EPA 2005) and converting units by dividing by 1,000 grams per kilogram [g/kg].

4.2.2 Recreational Turkey Hunter Exposure Scenario

Wild turkey is also a regionally popular game species. An adult and child recreational turkey hunter exposure scenario will be evaluated in the HHRA to evaluate exposures from ingestion of turkey meat from game taken near the EBV facility. The nearest pasture and natural lands were selected as representative locations for the turkey hunter scenario assuming that turkey forage in these areas. Preliminary locations include pasture habitat on the west side of CR 180 and natural land near the confluence of Grove Creek and Center Creek north of the facility. These locations are shown on Figure 2.

Default exposure parameter values for adult body weight, exposure duration, and averaging times presented in EPA (2005) for the adult and child resident exposure scenarios will be used to evaluate the turkey hunter exposure scenario. The exposure frequency value will be set equal to 365 days per year because the recreational turkey hunter is assumed to consume meat taken from or near EBV throughout the year. The consumption rates for chicken provided in EPA (2005) will be used as surrogate intake values in the evaluation of the adult and child recreational turkey hunter scenarios. Exposure parameter values to be used to evaluate the adult and child turkey hunter exposure scenarios are presented in Appendix A.

5.0 REFERENCES

EBV Explosives Environmental Company (EBV). 2001. "Resource Conservation and Recovery Act Reactive Waste Incineration Facility Permit Application." Submitted to Missouri Department of Natural Resources Hazardous Waste Program. January.

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APPENDIX A
EXPOSURE PARAMETERS FOR THE HUMAN HEALTH RISK ASSESSMENT
EBV EXPLOSIVES ENVIRONMENTAL COMPANY
JOPLIN, MISSOURI

(Three Pages)

TABLE A-1

EXPOSURE PARAMETERS FOR THE HUMAN HEALTH RISK ASSESSMENT
EBV EXPLOSIVES ENVIRONMENTAL COMPANY
JOPLIN, MISSOURI

	Resident		
Exposure Parameters	**Adult**	**Child**	**Reference**
Body Weight (kg)	70	15	EPA 2005
Exposure Duration (yr)	30	6	EPA 2005
Averaging Time (carcinogens) (yr)	70	70	EPA 2005
Averaging Time (noncarcinogens) (yr)	30	6	EPA 2005
Inhalation of Ambient Air			
Exposure Frequency (d/yr)	350	350	EPA 2005
Inhalation Rate (m^3/hr)	0.63	0.30	EPA 2005
Ingestion of Surface Soil			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (g/d)	0.1	0.2	EPA 2005
Ingestion of Homegrown Produce			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (kg/kg BW/d DW)			
Exposed Aboveground Produce	0.0003	0.00042	
Protected Aboveground Produce	0.00057	0.00077	
Belowground Produce	0.00014	0.00022	EPA 2005
Ingestion of Drinking Water from Mississippi River			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (L/d)	1.4	0.67	EPA 2005
	Farmer		
Exposure Parameters	**Adult**	**Child**	**Reference**
Body Weight (kg)	70	15	EPA 2005
Exposure Duration (yr)	40	6	EPA 2005
Averaging Time (carcinogens) (yr)	70	70	EPA 2005
Averaging Time (noncarcinogens) (yr)	40	6	EPA 2005
Inhalation of Ambient Air			
Exposure Frequency (d/yr)	350	350	EPA 2005
Inhalation Rate (m^3/hr)	0.63	0.30	EPA 2005
Ingestion of Surface Soil			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (g/d)	0.1	0.2	EPA 2005
Ingestion of Drinking Water from Mississippi River			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (L/d)	1.4	0.67	EPA 2005
Ingestion of Homegrown Produce			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (kg/kg BW/d DW)			
Exposed Aboveground Produce	0.0003	0.00042	
Protected Aboveground Produce	0.00057	0.00077	
Belowground Produce	0.00014	0.00022	EPA 2005
Ingestion of Homegrown Meat, Eggs, and Milk			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate of Beef (kg/kg BW/d)	0.00114	0.00051	EPA 2005
Ingestion Rate of Cow's Milk (kg/kg BW/d FW)	0.00842	0.01857	EPA 2005
Ingestion Rate of Poultry (kg/kg BW/d FW)	0.00061	0.000425	EPA 2005
Ingestion Rate of Eggs (kg/kg BW/d FW)	0.00062	0.000438	EPA 2005
Ingestion Rate of Pork (kg/kg BW/d FW)	0.00053	0.000398	EPA 2005

TABLE A-1 (Continued)

EXPOSURE PARAMETERS FOR THE HUMAN HEALTH RISK ASSESSMENT
EBV EXPLOSIVES ENVIRONMENTAL COMPANY
JOPLIN, MISSOURI

Exposure Parameters	Fisher		
	Adult	Child	Reference
Body Weight (kg)	70	15	EPA 2005
Exposure Duration (yr)	30	6	EPA 2005
Averaging Time (carcinogens) (yr)	70	70	EPA 2005
Averaging Time (noncarcinogens) (yr)	30	6	EPA 2005
Inhalation of Ambient Air			
Exposure Frequency (d/yr)	350	350	EPA 2005
Inhalation Rate (m^3/hr)	0.63	0.30	EPA 2005
Ingestion of Surface Soil			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (kg/d)	0.1	0.2	EPA 2005
Ingestion of Drinking Water from the Mississippi River			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (kg/d)	1.4	0.67	EPA 2005
Ingestion of Homegrown Produce			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (kg/kg BW/d DW)			
Exposed Aboveground Produce	0.0003	0.00042	
Protected Aboveground Produce	0.00057	0.00077	
Belowground Produce	0.00014	0.00022	EPA 2005
Ingestion of Fish			
Exposure Frequency (d/yr)	350	350	EPA 2005
Ingestion Rate (kg/kg BW/d FW)	0.00117	0.000759	EPA 2005
Exposure Parameters	**Recreational Deer Hunter**		
	Adult	**Child**	**Reference**
Body Weight (kg)	70	15	EPA 2005
Exposure Duration (yr)	30	6	EPA 2005
Averaging Time (carcinogens) (yr)	70	70	EPA 2005
Averaging Time (noncarcinogens) (yr)	30	6	EPA 2005
Ingestion of Deer Meat			
Exposure Frequency (d/yr)	365	365	--
Ingestion Rate (kg/d)	0.00133	NA	EPA 1997[a]
Exposure Parameters	**Recreational Turkey Hunter**		
	Adult	**Child**	**Reference**
Body Weight (kg)	70	15	EPA 2005
Exposure Duration (yr)	30	6	EPA 2005
Averaging Time (carcinogens) (yr)	70	70	EPA 2005
Averaging Time (noncarcinogens) (yr)	30	6	EPA 2005
Ingestion of Turkey Meat			
Exposure Frequency (d/yr)	365	365	--
Ingestion Rate (kg/kg BW/d FW)	0.00061	0.000425	EPA 2005[b]

Notes:

U.S. Environmental Protection Agency (EPA). 1991. "Memorandum Regarding the Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors." From Timothy Fields, Jr. Acting Director, Office of Solid Waste and Emergency Response. To Distribution. March 25.

EPA. 1997. *Exposure Factors Handbook.* Office of Health and Environmental Assessment. EPA/600/P-95/002Fa. August.

TABLE A-1 (Continued)

EXPOSURE PARAMETERS FOR THE HUMAN HEALTH RISK ASSESSMENT
EBV EXPLOSIVES ENVIRONMENTAL COMPANY
JOPLIN, MISSOURI

EPA. 2005. *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. Final. Office of Solid Waste. (5305W). EPA530-R-05-006. September.

a	Recommended ingestion rate for game meat in non-metropolitan locales (Table 11-6).
b	Recommended ingestion rate for poultry meat.
c	Recommended ingestion rate for fish for freshwater angler.
d	Recommended inhalation rate for outdoor worker.

BW	Body weight
d/yr	Day per year
DW	Dry weight
FW	Fresh (wet) weight
g	Gram
g/d	Gram per day
hr/d	Hours per day
kg	Kilogram
kg/kg BW/d	Kilogram food per kilogram body weight per day
L/d	Liter per day
m^3/hr	Cubic meter per hour
NA	Not available
yr	Year

Detailed Facility Description

B. PART B PERMIT APPLICATION REQUIREMENTS

SECTION 1

1.0 GENERAL FACILITY DESCRIPTION

This section of the permit application contains a general facility description as required by 10 CSR 25-7.270(2)(B) and 40 CFR 270.14. The information provided is supplied to acquaint the reviewer and the permit writer with an overview of the facility. Specific areas of the facility are described in greater detail throughout this document. The Table of Contents can be referenced to identify these locations.

1.1 OWNER AND OPERATOR

EBV Explosives Environmental Company dba General Dynamics Ordnance and Tactical Systems Munition Services (GD-OTS MS) is the owner and operator of the reactive waste Treatment, Storage, and Disposal Facility (TSDF). GD-OTS MS is owned by General Dynamics Ordnance and Tactical Systems, St. Petersburg, FL.

<u>Physical Address:</u>
General Dynamics OTS Munition Services4174
County Road 180
Carthage, Missouri 64836

<u>Mailing Address:</u>
General Dynamics OTS Munition Services
P.O. Box 1386
Joplin, Missouri 64802

1.2 FACILITY DESCRIPTION

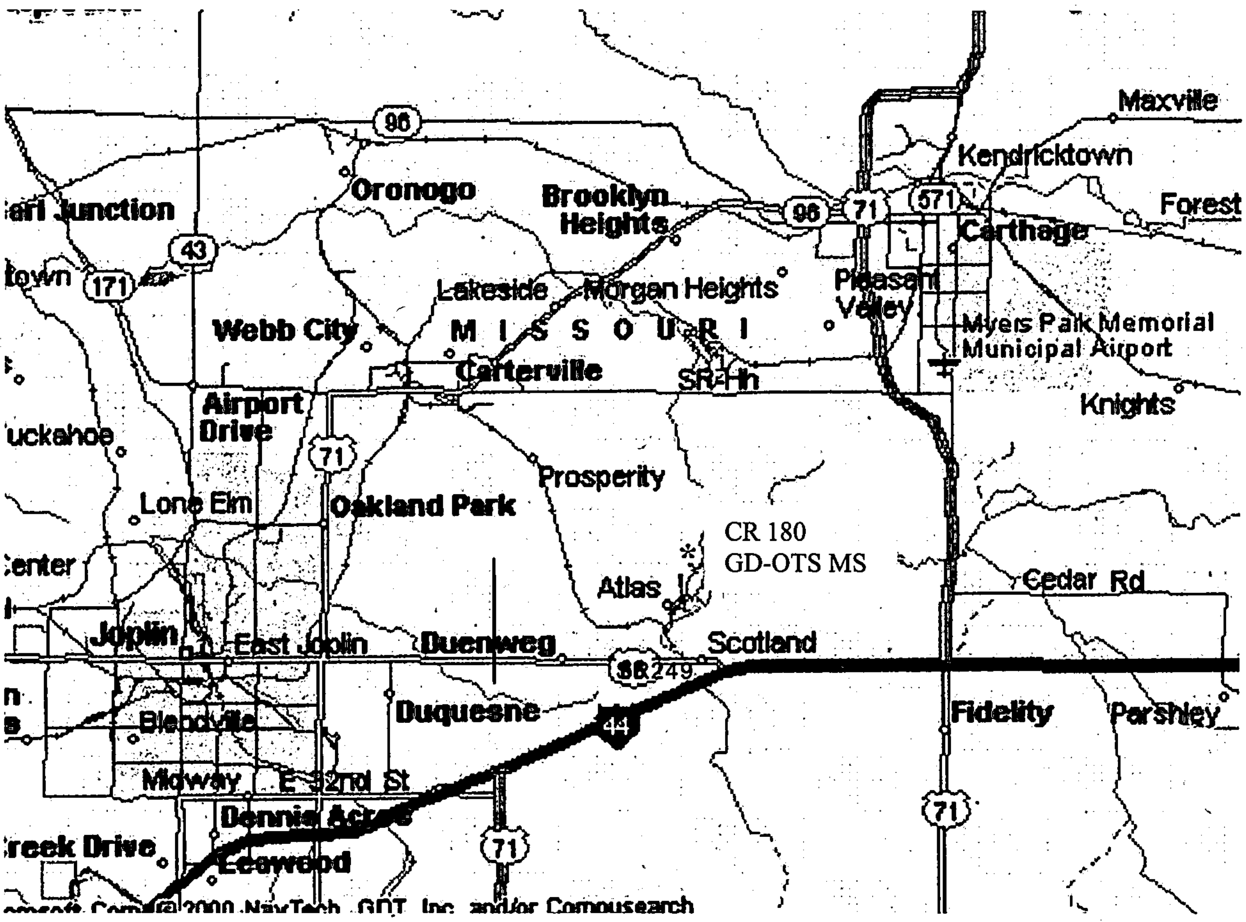
The TSDF owned and operated by GD-OTS MS is located at 4174 County Road 180, Carthage, , Jasper County, Missouri. Figure 1-1 shows the facility location on the Missouri map and Figure 1-2 shows the facility location on the Joplin/Webb City Area Map. Figure 1-3 shows the complete GD-OTS MS Facility.

Figure 1-1

GD-OTS MS Facility Location Within Missouri

Figure 1-2

GD-OTS MS Facility Location On Joplin/Webb City Area Map



The GD-OTS MS Facility consists of numerous operating buildings and areas, and storage magazines, located within a 55-acre site. The Operations Area and Magazine Storage Area are within a fenced area. Access into the Operations Area and Magazine Area is via the Main Plant Outer Gate off of County Road 180, as described in Section 3. The main parts of the Facility are shown on Figures 1-3 and 1-4, and are listed below with a brief description of each.

- Administrative Office and Main Security Gate
- Building No. 1 MLRS/ICM Disassembly Building
- Building No. 2 MLRS Download and Disassembly Building
- Building No. 3 Propellant Thermal Treatment Process
    - Preparation Bay
    - Rocket Motor Saw Bays
    - Transfer Room
    - Propellant Thermal Treatment Chambers
    - Air Pollution Control System

  Building No. 4 CBU Disassembly Building
- Building No. 5 Storage/Feed Handling Building
- Building No. 6 Incineration Complex
    - Control Room
    - Feed Room
    - Kiln Containment Room
    - Residuals Handling Room
    - 90-Day Storage Area
    - Air Pollution Control System Area
    - Induced Draft Fans and Stack Area
    - Continuous Emissions Monitoring Building
    - Car Bottom Furnace Room
    - Utilities Building
- Building No. 8 Field Office/Change House

  Building No. 9 Maintenance Shop

  Building No. 10 Water Well Building
- Magazine Area (Magazine Nos. 1, 2, 3, and 4)

1.2.1 Administrative Office and Main Security Gate

The Administrative Office and the Main Security Gate (Gate No. 1-see Figure 1-5) are located adjacent to each other. The Administrative Office houses management, clerical, financial, recordkeeping operations, and environmental management functions. All regulatory agency personnel visiting GD-OTS MS will check in at the Administrative Office. The Main Security Gate is where all traffic entering and exiting the GD-OTS MS Facility is controlled. When an incoming load of waste is received, the truck driver will sign in at the Main Security Gate, and then will be escorted to the Main Plant Outer Gate (Gate No. 2). Details of the handling of shipments of waste and associated traffic management are detailed in Section 3. Procedures for receipt of waste shipments involve verification of manifests, waste sampling and fingerprinting. Details are contained in Sections 3, 4, and 7.

1.2.2 Building No. 8 Field Office/Change House

The Field Office/Change House is located outside of, but adjacent to the GD-OTS MS Plant Operations Area. It houses supervisor offices, the maintenance office and work area, the employee lunchroom, instrument calibration and repair laboratory, employee change rooms, showers, and restroom facilities, and a laundry room. All personnel in the Field Office directly support Plant operations and Magazine storage operations.

1.2.3 Building No. 1 MLRS/ICM Disassembly Building

The MLRS/ICM Disassembly Building consists of two separate parts, a non-RCRA regulated disassembly area, and a RCRA Subpart X thermal treatment area. In the non-RCRA area, military munitions are downloaded in safety cells and the submunitions disassembled using unattended, automated equipment to remove and disassemble the submunitions. Disassembled submunitions are subsequently thermally treated in the RCRA Subpart X area of the building.

The RCRA Subpart X thermal treatment area consists of four Contained Thermal Treatment Chambers (CTTC) where the explosives in the submunitions are ignited by natural gas fired torches and allowed to burn in the chambers. There also are four electrically-heated Static Kilns (SK) in which the fuzes from the submunitions are thermally treated. Emissions from the thermal treatment of the explosives in the submunitions and fuzes are controlled by APCSs servicing the thermal treatment processes. Additional detail of this building and processes is contained in Section 10.

The Contained Thermal Treatment Process includes four Contained Thermal Treatment Chambers (CTTC) and four Static Kilns (SK), all of which are RCRA Subpart X miscellaneous units. The body of the submunition contains 17% (30 grams) of explosive material and no RCRA regulated chemicals. The submunition body is placed in a fixture on a conveyor that runs through a CTTC. The explosive material in the body is ignited by a natural gas fired torch and allowed to burn. All of the explosive material in each body is consumed in about 1 minute. Clean scrap metal is collected in the residuals area of this process. The chambers are held at a negative pressure by an induced draft fan on the Air Pollution Control System (APCS) through which the emissions are pulled for cleaning. The CTTC APCS consists of a Primary Cartridge Filter, and a H13 HEPA Filter to remove the very small amount of particulates that are generated by the burning explosives, and an Induced Draft Fan to pull all emission from the chambers thru the APCS to the Stack.

The second part of the submunition is the fuze that contains <1% (88 milligrams) explosive material with less than 0.38% lead. This fuze is conveyed into a separate chamber where it is dropped into an electrically heated SK. The heat from the electric heater on the outside of the SK causes the explosive materials to ignite. The emissions from the burning of the explosive material may include a minute amount of lead, which is pulled into the SK APCS for cleaning. Since the SK is a batch type unit, GD-OTS MS has four SKs with the emission going to the APCS referenced above. Only one SK is operated at a time. While the one kiln is in operation and reaching filling capacity, a second SK is heated in preparation for receiving the fuzes for thermal treatment. A third SK would be in the process of cooling down from completion of a batch treatment prior to opening the SK and removing the metal residue. A fourth SK is used as backup during routine maintenance of the SKs. The APCS for the SKs is a Primary Cartridge Filter and H13 HEPA Filter, with an Induced Draft Fan to pull all emissions from the SKs through the APCS to the Stack.

1.2.4 Building No. 2 MLRS Download and Disassembly Building

The MLRS Download and Disassembly Building is a non-RCRA regulated building used for downloading of MLRS rockets from shipping/firing pods, and separation of the warheads and rocket motors. Explosive components removed from the rockets in this disassembly operation are subsequently declared as hazardous waste and are processed through the Building No. 6 Incineration Complex. The warhead is transported to Building No. 1 for additional download and disassembly. The rocket motor is declared as hazardous waste and subsequently processed for disposal in the Building No. 3 Propellant Thermal Treatment Process.

1.2.5 Building No. 3 Propellant Thermal Treatment Process

The Propellant Thermal Treatment Process is a RCRA Subpart X regulated building and process for disposal of the MLRS rocket motors. It consists of a Preparation Bay, two Saw Bays, a Transfer Room, two Propellant Thermal Treatment Chambers (PTTC), and an Air Pollution Control System (APCS). The Rocket Motor contains 216.5 pounds of a case bonded Ammonium Perchlorate based propellant. In this building and process, the MLRS rocket motors are cut into segments using underwater saws. The cut segments are transferred from the saw bays into a Transfer Room, then into one of the two PTTCs where they are ignited using a natural gas fired torch. The torch ignites the propellant which is allowed to burn in the rotary conveyor inside of the PTTC. Clean scrap metal is collected in containers. The chamber is held at a negative pressure by an induced draft fan on the APCS through which the emissions are pulled.

The APCS consists of a Quench Chamber to cool the gases and to inject the sodium bicarbonate to neutralize the chlorine and acid gases, a Reaction Chamber (former Spray Dryer) to increase the neutralization and where activated carbon is injected for organics removal, a Baghouse to filter the particulates and a Wet Scrubber to complete the neutralization and particulate filtration of the exhaust gases. An Induced Draft Fan pulls all emission from the chambers thru the APCS to the Stack. Figure 1-3 shows the location of the new unit, Figure 19-3 shows the layout of the building and Figure 19-4 shows the layout of the APCS.

1.2.6 Building No. 4 CBU Disassembly Building

The CBU Disassembly Building is a non-RCRA regulated building where Cluster Bomb Units (CBU) are disassembled to remove the multiple bomblets from the dispenser. The bomblets are conveyed into a safety cell consisting of 12" reinforced concrete walls. In the safety cell, the bomblets are disassembled by automated, unattended equipment which opens the bomblets and removes the fuzes. The bomblet halves and fuzes exit the safety cell where they are packaged for subsequent transfer and incineration in the Building No. 6 as hazardous waste.

1.2.7 Building No. 5 Storage/Feed Handling Building

The Storage/Feed Handling Building (SFHB) is a storage and containment structure which includes multiple concrete-walled bays and safety cells. Siting is based on safety considerations as specified by the DoD Quantity Distance Tables. The structure is located approximately 290 feet from the Incinerator and associated air pollution control system (APCS) equipment. The SFHB is where desensitization/disassembly/repackaging/staging operations take place. The purpose of these operations is to render materials with unusual hazards, less hazardous to handle, feed or burn. Additional details of the SFHB can be found in Section 9.

1.2.8 Building No. 6 Incineration Complex

The Incineration Complex consists of two incinerators regulated by MACT. The hazardous waste handling operations are performed in accordance with RCRA regulations. The Incineration Complex consists of a Control Room, Feed Room, Kiln Containment Room, Residuals Handling Room, 90-Day Storage Area, Air Pollution Control System Area, Induced Draft Fan Area, Controlled Emissions Monitoring Building, Utilities Building, and Car Bottom Furnace.

The Control Room is where the incineration process and feeding operations are controlled for the Rotary Kiln Incinerator (RKI) and Car Bottom Furnace (CBF). This room is adjacent to the Feed Room and the Kiln Containment Room, separated by concrete blast walls. All operational controls for the incineration plant, consisting of a redundant Distributed Control Systems (DCS), are located in the Control Room. Plant operators observe the kiln feeding operation via CCTV monitors. In addition, the Control Room monitors all other operations in the Plant Operations Area using CCTV monitors, including operations at the Magazines. There are numerous CCTV Cameras located throughout all of the plant operations. Multiple monitors are located in the Control Room by which plant operations are monitored.

Waste from magazines or from the Storage/Feed Handling Building is loaded onto a transport vehicle for carrying the waste to the Feed Room. A maximum volume of waste sufficient for up to four hours of incineration operation will be moved at one time. The unloading area is covered by a metal roof. The unloading pad is concrete with berms to contain all spills. Wastes are introduced into the RKI from the Feed Room.

The Kiln Containment Room houses the charge conveyor, the RKI, and portions of the feed conveyor and the discharge skip hoist.

The Residuals Handling Room contains a vibrating conveyor for separating the ash and metals discharged from the RKI. Metals are recovered for recycling and ash is collected for disposal as hazardous waste in a permitted HW landfill

The 90-Day Storage Area is a bermed concrete pad within a three-sided metal building. A drain from the concrete pad is connected to the Air Pollution Control System (APCS) Area collection sump to control spills and precipitation. Ash residuals for disposal are dumped into ash roll-off containers for transport to an off-site, permitted, hazardous waste landfill for disposal. A residuals sampling program is utilized to ensure proper disposal of all residuals. Residual metals are inspected in this area to ensure they have been inerted by the incineration process. Residual metals are dumped in roll-off bins for removal from the site and transport to commercial recycling facilities.

Air Pollution Control System (APCS) Area

The APCS area includes the Secondary Combustor, Spray Dryer, Baghouses and support equipment. After exiting the RKI, the exhaust gas enters the Secondary Combustor, where the gas is heated to 1800 - 2200°F by burning natural gas auxiliary fuel. This elevated temperature, in conjunction with the gas residence time of greater than four seconds, ensures the complete destruction of organic materials. After exiting the Secondary Combustor, the exhaust gas then enters the Spray Dryer into which soda ash slurry is sprayed to remove acid gases as well as to cool the exhaust to the operating temperature range of the Baghouse. The exhaust gases leaving the Spray Dryer are then sent to the Baghouses. The dust collected on the bags is removed by reverse pulses of compressed air being applied to the inside of the bags. The dust falls to the bottom of the baghouse where it is removed through a rotary valve. The dust is placed in the ash roll-off and sent to a RCRA approved hazardous waste landfill.

All of the APCS equipment is located on a curbed concrete pad which is sealed with an epoxy coating to prevent leakage of water from the pad. Rain water and any other water that falls on the APCS pad flows into the Sump where it is pumped into Tank TK-103 from which it is pumped for use in the spray dryer as quench water. In this manner, no liquid effluent from the APCS leaves the plant.

Two parallel induced draft fans are provided to move the exhaust gas to the stack. Each fan is designed to handle 100 percent of the total gas flow. Both fans are generally operated at the same time, unless it is necessary to shut down one of the fans for maintenance. The stack is 65 meters in height.

The Continuous Emissions Monitoring Building is located at the base of the stack. Located in the building is the sampling equipment that continuously monitors the stack gases for CO in ppm, Hydrocarbons in %, O_2 in %, opacity in %, stack flow rate and temperature.

Car Bottom Furnace (CBF)

The Car Bottom Furnace is a natural gas fired incinerator designed to decontaminate large, unusual or irregular shaped metal pieces and incinerate contaminated combustible materials such as rags, coveralls, and packaging materials. The furnace system consists of a Car Bottom Furnace, Overhead Hoist, Car Bottom Furnace Track Scale and a Car Bottom Furnace Baskets.

The Utilities Building houses the Soda Ash Tanks where soda ash is mixed and metered to the spray dryer in the APCS for acid gas control. It also houses the air compressors that provide compressed air supply for operating the plant, an emergency backup generator for supplying electricity to allow an ordered shutdown of the plant in the event of an electrical power failure, and the electrical motor control center.

1.2.9 Maintenance Shop

The Maintenance Shop is a non-RCRA regulated building housing maintenance equipment, operations, and supply of parts and materials for maintenance support of all of the plant operations and buildings.

1.2.10 Magazine Storage Area

All explosive wastes are stored in the four aboveground storage magazines in the Magazine Storage Area. The magazines meet DoD, ATF, and EPA construction, storage, and security standards. All magazines are used for storage of explosive solids, reactive wastes and DoD materials, as needed. Waste compatibility is maintained in each magazine. The containerized wastes are stored in in accordance with 40 CFR 264.177. Because of the explosive nature of the waste materials, many of which are military munitions, safety requirements of DOD 4145.26-M, "DoD Contractors; Safety Manual for Ammunition and Explosives", regarding waste compatibility, container type, and quality limits are followed in meeting storage compatibility requirements. The net explosive weight of waste in storage, per magazine, at any time will not exceed 100,000 lbs.

1.3 WASTE DESCRIPTION

GD-OTS MS is a commercial demilitarization, incineration, and thermal treatment facility to service the explosive manufacturing industry, government agencies such as DoD, and other firms that produce or use materials that are considered reactive or explosive. Most waste received at the Facility is off-specification explosives or explosive containing devices, pharmaceuticals containing explosives, riot control materials, ammunition and propellants. Residual wastes from spill cleanups, plant manufacturing wastes, and related explosive industry wastes are also accepted.

1.4 WATER SUPPLY

Water for GD-OTS MS plant operations is supplied from a 35,000 gallon vertical storage tank. The tank is maintained at a level between 85% and full. Plant water well provides resupply water to the tank in excess of the largest single plant demand. The GD-OTS MS Facility fire water supply is a buried 6" line circling the incineration plant. Line pressure is 60 psi. Water is supplied to all process buildings as needed, from the water supply system.

1.5 FIRE CONTROL

Fires involving explosive/reactive waste (i.e., ammunition and explosives) will not be fought. The industry-wide procedure of not fighting explosive/reactive waste fires is based on the need to protect human life. GD-OTS MS follows the Institute of Manufacturers of Explosives "Safety

Publication Number 4" and the DOD4145.26M, "Contractors' Safety Manual for Ammunition And Explosives" guidance in not fighting explosive/reactive waste fires. The Duenweg Volunteer Fire Department (DVFD) provides fire fighting services to GD-OTS MS in areas where fire fighting is permitted, which would essentially consists of grass and brush fires away from explosives buildings. Fire hydrants in the GD-OTS MS Facility are compatible with the DVFD fire equipment. In addition, all buildings are constructed in a fire proof manner with steel and concrete construction, (see Section 2) and all brush and trees are cleared, and height of grass is controlled, for a distance of at least 50 feet from each magazine and buildings. The 50-foot clearings around each magazine, including the 15 foot graveled areas adjacent to the magazines, function as fire breaks. Additional specifics regarding fire prevention and fire control are described in the detailed Contingency Plan in Section 6.

1.6 SURROUNDING LAND USE AND WATER

The property directly surrounding and within at least 1000 feet of the GD-OTS MS Facility, in all directions, is owned by Expert Management, Inc. (EMI) . Much of this property was originally used for the manufacturing of commercial explosives. However, all operations on EMI property have been discontinued, all facilities have been demolished, and the land returned to its natural state for the most part. The EMI property is currently undergoing environmental remediation or awaiting approval of remediation plans. Surrounding the EMI property, the land can be characterized as agricultural crop land and pasture, urban or built-up industrial, mixed rangeland and mixed forest land. There are some small residential areas; however, the majority of the surrounding properties are small to mid-sized farms.

Water courses nearest the GD-OTS MS facility include Center Creek, Grove Creek, some minor unnamed tributaries to the above-named creeks and some small unnamed ponds, none of which are within 1000 feet of the GD-OTS MS Facility. Grove Creek flows through the EMI property, and is less than one-half mile from the location of the GD-OTS MS Facility. There are no injection wells on the GD-OTS MS Facility, or within 1000 feet of the GD-OTS MS Facility. No fluids from the GD-OTS MS Facility are injected into underground wells. There is one withdrawal wells for providing the plant water supply located on the GD-OTS MS Facility. Location of the well is shown on Figure 1-3.

1.7 WEATHER-RELATED DESCRIPTIONS

The Joplin area is characterized by four separate and distinct seasons. Winters are cold and windy, with some snow accumulations. Spring is wet with moderate temperatures and numerous rainfall events. Summers are hot and muggy with sporadic thunderstorms and, on rare occasions, tornadoes. Fall is often drier with lowering temperatures. Meteorological data collected at the Joplin Regional Airport between 1973 and 2006/2007, obtained from the National Weather Service, is presented as wind roses (Figure 1-7) for each month of the year. The wind roses show distribution of wind direction per month at a site for the entire 24 hours. It shows the percentage of time the wind is from a certain direction using the rings and the color indicates what percentage of time the wind speed is from that direction. The top of the wind roses is north.

Figure 1-7
Wind Roses From National Weather Service Data From The Joplin Regional Airport – 1973-2006/2007

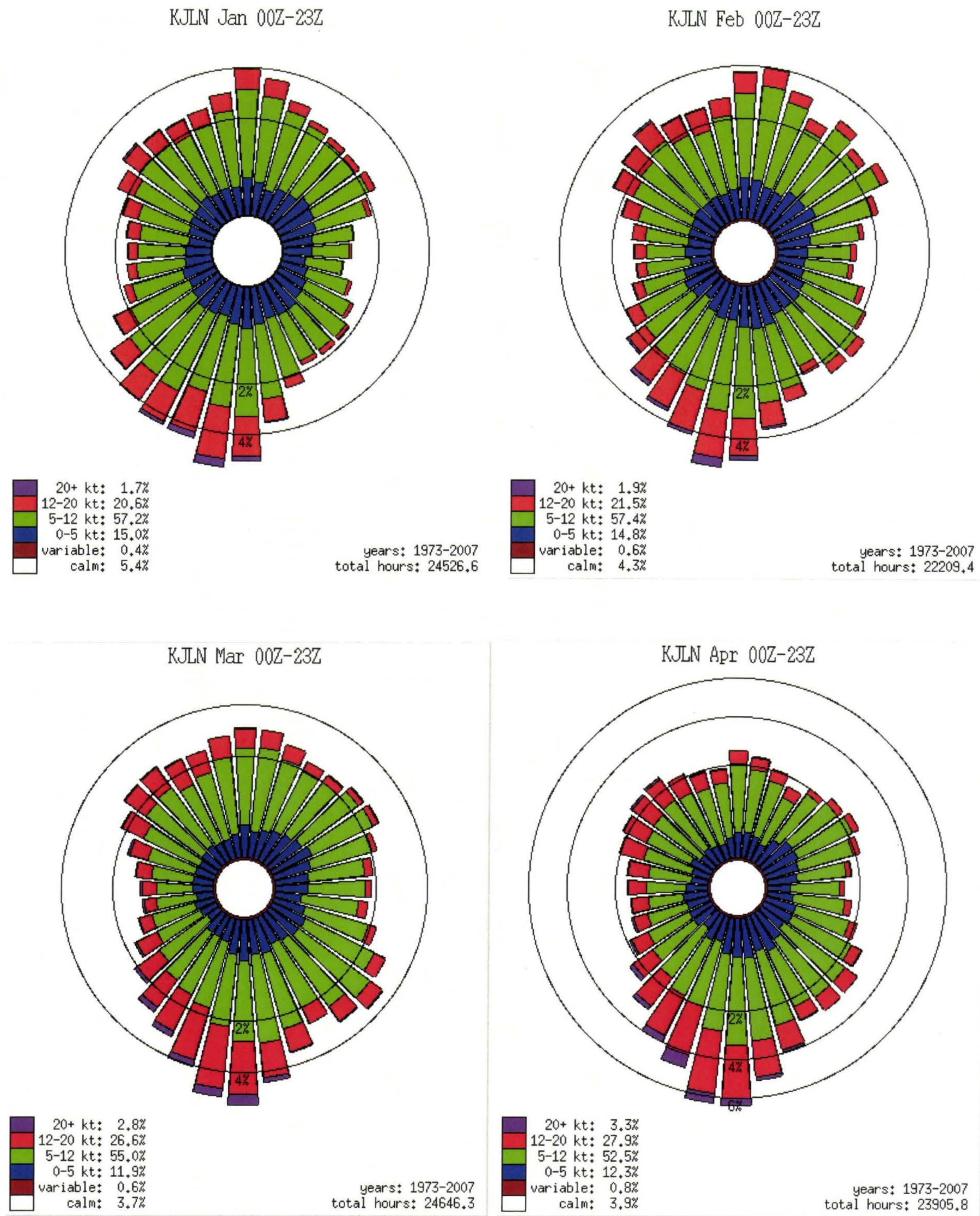


Figure 1-7 (Continued)
Wind Roses From National Weather Service Data From The Joplin Regional Airport 1973-2006/2007

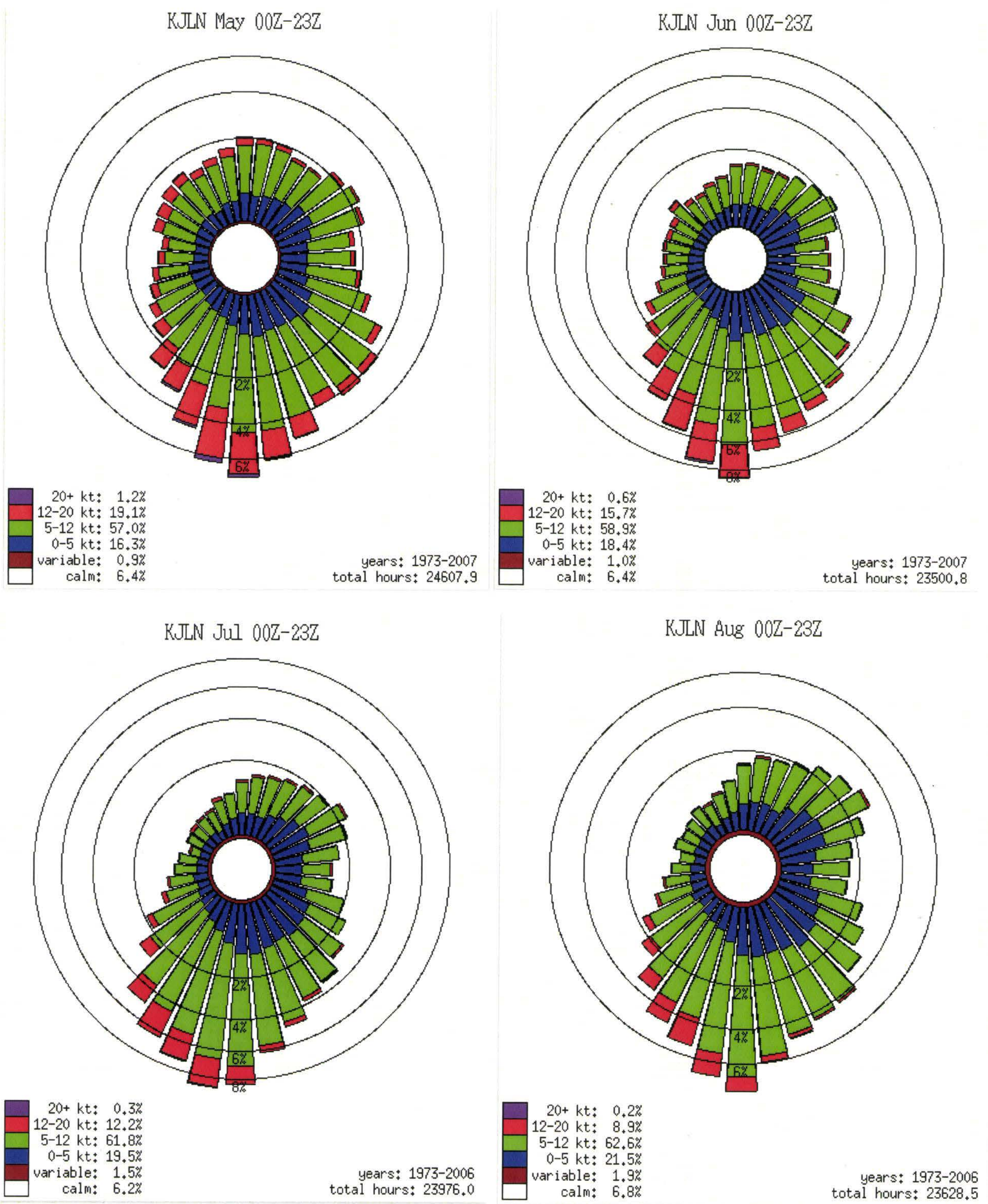


Figure 1-7 (Continued)
Wind Roses From National Weather Service Data From The Joplin Regional Airport
1973-2006/2007